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SYNOPSIS

OF

MINERAL CHARACTERS

ALPHABETICALLY ARRANGED FOR LABORATORY AND FIELD USE

BY

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FIRST THOUSAND

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PREFATORY NOTE.

THIS synopsis is designed to present in a systematic form the essential characters and the simplest determinative reactions of the common and important minerals. There are also included definitions of mineral terms and of those rocks associated with the minerals.

While not intended as a substitute for the ordinary determinative tables, it promotes sight recognition and does not encourage mechanical tendencies.

The application of chemical tests is left to the judgment of the individual, and emphasis is laid upon crystal form, habit, system, cleavage, hardness, fusion, and solubility in hydrochloric or other acid; all of which, excepting perhaps the last two, may be determined in the field.

The alphabetic arrangement adapts the synopsis for use with all systems of mineral classification.

CAMBRIDGE, MASS.
August, 1906.

ABBREVIATIONS.

B.B.	Before blowpipe.
Cv.	Cleavage.
Cl.Tb.	Closed tube.
D.	Dana's text-book.
Frt.	Fracture.
Fsy.	Fusibility.
H.	Hardness.
HCl	Hydrochloric acid.
HNO_3	Nitric acid.
H_2SO_4	Sulfuric acid.
iso. w.	Isomorphous with.
M. & P.	Moses & Parsons' text-book.
NH_4OH	Ammonium hydroxid.
O.F.	Oxidizing flame.
Per.	Perfect.
R.F.	Reducing flame.
q.v.	Which see.
Soda.	Sodium carbonate.
S.Ph.	Salt of fosforus, microcosmic salt.
Sp.Gr.	Specific gravity.
Stk.	Streak.
w.	With.

SYNOPSIS

OF

MINERAL CHARACTERS.

ACICULAR. Needle-like crystals.

ACTINOLITE. Calcium magnesium iron silicate, $Ca(Mg,Fe)_3(SiO_3)_4$.

Massive, fibrous, divergent, columnar or reticulated, and in two-edged prisms.

Green.

Prismatic Cv. perfect, with angle of about 120°.

Fuses at 4 to a green or a brown globule.

Tremolite = colorless globule.

Occ. In schists with talc and chlorite.

D. 400. M. & P. 390.

ADAMANTINE. The nearly oily luster of the uncut diamond and of other minerals having a high index of refraction.

ADULARIA. Colorless to white transparent, often opalescent, crystals of Orthoclase, q.v.

AGATE. See Chalcedony.

ALABASTER. See Gypsum.

ALBITE. Sodium aluminium silicate, $NaAlSi_3O_8$.

Massive, platy, and tabular crystals. Usually twinned.

2 cleavages at nearly 90°.

Fine parallel striations or re-entrant angles on base due to repeated twinning.

Generally white.

Fsy. 4–4.5. Orthoclase = 5.

Occ. Frequently accompanying quartz, tourmaline, topaz, beryl, and apatite. In granitic rocks, gneiss, or crystalline schists.

D. 377. M. & P. 382.

ALLANITE. A cerium epidote, q.v.

$Ca(Al,OH)(Al,Fe,Ce,La,Di)_2(SiO_4)_3$.

Nail-like and thin tabular crystals, veins and masses altering to rusty spots.

Pitchy luster.

Black or brownish, rusty.

Gray streak. Chromite = brown.

H. 5.5–6.

Fuses 2.5, swells to a dark magnetic glass insoluble in HCl.

Occ. In granite, gneiss, and syenite.

D. 440. M. & P. 408.

ALLEMONTITE. Arsenical antimony, $SbAs_2$.

Mammillary masses like native arsenic.

Tin-white, tarnishing gray. Arsenic = dark-gray tarnish.

H. 3.5.

Sp.Gr. 6.2. Arsenic = 5.7.

Fuses at 1, white fumes. Arsenic volatilizes without fusion.

In closed tube a sublimate of As and a fused globule of Sb.

Occ. In veins with arsenic, antimony, etc.

D. 275.

ALUM STONE. See Alunite.

ALUNITE. Hydrous sulfate of aluminium and potassium, $K_2(Al,2OH)_6(SO_4)_4$.

Massive, fibrous, granular, rarely cube-like rhombohedrons.

Vitreous and pearly luster.

White, gray, or red.

H. 3.5–4.

Infusible.

Occ. In veins in trachyte.

D. 537. M. & P. 351.

AMBER MICA. See Phlogopite.

AMBLYGONITE. Lithium aluminium fluo-fosfate, $Li(AlF)PO_4$.

Massive, compact, cleavable, columnar, and in large coarse blunt triclinic crystals.

White or pale colors.

Basal perfect cleavage (one direction). Spodumene has two or three.

Fuses 2, cooling to opaque white globule. Spodumene = 3.5 to clear white glass.

H. 6. Topaz = 8. **Crimson flame = Li.**

Sp.Gr. 3 Feldspar = 2.4–7.

Dip in H_2SO_4, heat strongly; green flame = P.

Occ. In pegmatites with other lithia minerals.

D. 503. M. & P. 316.

AMETHYST. Purple to violet Quartz, q.v.

AMORPHOUS. An amorphous mineral is one which is not crystalline, does not form crystals, and shows no evidence of a regular internal structure.

AMPHIBOLE. A ferro-magnesian silicate, $RSiO_3$. R = at least 2 of Ca, Mg, Fe, Al, or Na.

Monoclinic prismatic crystals with angle of 124°.

Manycolor (prevailingly green).

Cleavage parallel to prism, large angle 124°.

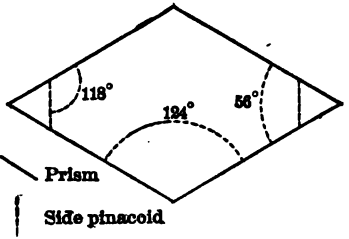

FIG. 1.—Cross-section of cleavage fragment showing the important forms and angles.

See varieties: Actinolite, Anthophyl-

lite, Asbestos, Hornblende, Nephrite or Jade, Tremolite.

D. 401. M. & P. 389.

AMYGDALOID. An igneous rock, usually a basalt or a diabase, filled with round or almond-shaped cavities, formed by steam bubbles in the fluid rock, which may contain minerals such as calcite, datolite, and the zeolites, introduced after the solidification of the rock.

AMYGDALOIDAL. Almond-shaped mineral kernels from or filling cavities in amygdaloid.

ANALCITE. **Hydrated sodium aluminium silicate,** $NaAl(SiO_3)_2 + H_2O$.

Trapezohedrons or modified cubes, rarely massive, granular, or compact.

Ice-like.

H. 5–5.5. Garnet = 7.

Fuses 2.5 without intumescence to a colorless glass. Leucite = infusible.

Cl.Tb. Yields water. Leucite does not.

Occ. In amygdaloids alone or with other zeolites, prehnite, datolite, etc.

D. 460. M. & P. 415.

ANATASE. See Octahedrite.

ANDALUSITE. **Aluminium silicate,** Al_2SiO_5.

Tough, massive, columnar, coarse, nearly square orthorhombic prisms.

Cleavage imperfect. Fibrolite = side pinacoid perfect.

H. 7.

Infusible.

Occ. A contact product in clay-slate, knotted schists, etc., with albite, cyanite, fibrolite, staurolite, quartz, etc.

D. 432. M. & P. 404.

ANDRADITE. A calcium iron Garnet, q.v.

ANGLESITE. Lead sulfate, $PbSO_4$.
Massive, often concentric layers about core of galena, and in orthorhombic crystals.
Untwinned. Cerussite is generally twinned.
Sp.Gr. 6.25. Heavier than barite and celestite.
Does not effervesce in acid. Cerussite does.
Occ. With exposed galena deposits.
D. 527. M. & P. 259.

ANHYDRITE. Calcium sulfate, $CaSO_4$.
Massive, granular, sugar-like, fibrous, lamellar, rarely in crystals.
Pseudo-cubic Cv. parallel to 3 orthorhombic pinacoids.
H. 3–3.5. Gypsum = 2.
Does not effervesce in acids like calcite.
Fuses 3–3.5.
Occ. With rock salt, limestone, and sometimes hydrated to gypsum.
D. 528. M. & P. 327.

ANNABERGITE. Hydrous nickel arsenate, $Ni_3(AsO_4)_2 2H_2O$.
Crusts and very rarely small fibrous crystals.
Pale apple-green.
On charcoal fuses easily, garlic odor, magnetic globule.
Soluble in HNO_3 to green solution.
Occ. Alteration product called **nickel bloom** coating nickel arsenids.
D. 509. M. & P. 239.

ANORTHITE. Calcium aluminium silicate, $CaAl_2Si_2O_8$.
Rare plagioclase feldspar occurring in small glassy crystals and larger white crystals enclosing chrysolite and often covered with a black crust.
Triclinic.
D. 380. M. & P. 382.

ANTHOPHYLLITE. Magnesium iron silicate, $(Mg,Fe)SiO_3$.

Orthorhombic amphibole. Massive, lamellar, fibrous, reticulated, columnar.

Prismatic cleavage.

H. 5.5–6. Often soft from alteration. Does not react for Ca. Actinolite asbestos does.

Occ. In schists with hornblende, tremolite, actinolite, and biotite.

D. 398.

ANTIMONY. Native element, Sb.

Massive, lamellar.

Metallic.

Light steel-gray to tin-white.

H. 3–3.5. Brittle.

Basal Cv. prominent.

Fuses at 1, dense white, inodorous fumes, completely volatile.

Occ. Often with stibnite, usually coated with earthy white oxid of antimony.

D. 275. M. & P. 273.

APATITE. Calcium fosfate, $Ca_4(Ca,F)(PO_4)_3$.

Prismatic hexagonal crystals variously modified, massive, stony, nodular, and granular.

Manycolor, especially brown and green.

H. 5. Beryl = 7.5+.

Cleavage lacking or imperfect.

Very brittle.

Edges often rounded as if fused.

Infusible.

Occ. Accessory rock constituent with zircon and magnetite.

D. 497. M. & P. 330.

APOPHYLLITE. Hydrated calcium potassium silicate, $H_7KCa_4(SiO_3)_8+4\frac{1}{2}H_2O$.

Cube-like tetragonal crystals with a pair of dull faces (basal). Massive, lamellar.

Square glassy prism vertically striated and modified by base and pyramid.
Basal cleavage perfect.
H. Base = 5. Prism = 6.
Exfoliates, fuses 1.5.
Occ. In amygdaloid with zeolites, carbonates, datolite, etc.
D. 452. M. & P. 413.

AQUAMARINE. See Beryl.

ARAGONITE. Calcium carbonate, $CaCO_3$.
Massive, radiated, stalactitic, imitative, and in orthorhombic crystals.
Side pinacoidal Cv. Calcite = rhombohedral.
H. 3.5–4. Calcite = 3.
Sp.Gr. 2.94. Calcite = 2.7. Strontianite = 3.7. Witherite = 4.32.
Effervesces in dilute HCl. Natrolite does not.
Infusible, crumbles.
Occ. With beds of serpentine, gypsum, and iron ores.
D. 361. M. & P. 332.

ARGENTITE. Silver sulfid, Ag_2S.
Massive, granular, encrusting, platy, dendritic, and rarely in cubic or octahedral crystals.
H. 2–2.5. Cuts like wax. Other soft black metallic minerals do not.
Shiny lead-gray streak.
On charcoal fuses 1.5 and reduces easily to metallic silver.
Soluble in dilute HNO_3 with separation of S. Cerargyrite is not.
Occ. With galena, ruby silver, sphalerite, etc.
D. 288. M. & P. 297.

ARSENIC. Native element, As.
Massive, rounded (onion-like), curvilaminar, reniform, and granular.
Metallic luster.
Light steel-gray, tarnishing dull black.

H. 3.5. Brittle.

Sp.Gr. 5.7. Allemontite = 6.2.

Volatilizes without fusion, white fumes with garlic odor. Allemontite = 1 and white coat on charcoal.

Occ. In veins with Sb minerals, proustite, realgar, etc.

D. 274. M. & P. 270.

ARSENOPYRITE. Iron sulfarsenid, FeAsS.

Columnar, straight or divergent, granular, compact, and rarely in pointed orthorhombic crystals with horizontally striated faces.

Silver-white, steel-gray.

Yields garlic odor when struck with hammer.

Fuses 2, white fumes with garlic odor, to magnetic globule.

H. 5–6.

When massive determined from Smaltite by borax-bead test for iron.

Occ. In quartz veins and with gold, lead, and tin minerals.

D. 303. M. & P. 214.

ASBESTIFORM. Separable into fine cotton-like fibers, e.g., fibrous serpentine, Chrysotile.

ASBESTOS. Calcium magnesium silicate, $CaMg_3(SiO_3)_4$.

The asbestiform variety of tremolite, occurring in sheets and cork-like masses.

H. 2–2.5.

White or gray. Chrysotile (Asbestos serpentine) is green when compact, and yields water in closed tube.

D. 401. M. & P. 390.

ASPARAGUS-STONE. See Apatite.

ATACAMITE. Hydrous copper chlorid, $Cu(OH)Cl.Cu(OH)_2$.

Slender prismatic orthorhombic crystals, massive, fibrous, granular to compact, as sand.

Various shades of green.
Side pinacoidal Cv. per.
H. 3–3.5.
In closed tube yields much water and a gray sublimate.
Fuses at 3.5, Cu flame, brown and gray coat, reduces to metallic Cu.
Occ. With malachite and cuprite.
D. 322. M. & P. 289.

AUGITE. Calcium magnesium aluminium silicate, etc., $RSiO_3$ w. $(Al,Fe)_2O_3$. R = Ca, Mg, Fe, and Mn.
Massive or monoclinic crystals with prismatic angles near 90°.

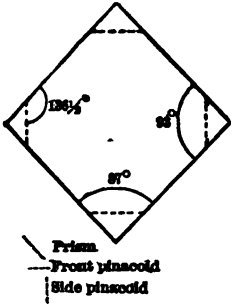

FIG. 2.—Cross-section of crystal showing important forms and angles.

Cv. lacking or prismatic with angles near 90°. Hornblende = prismatic Cv. prominent, with large angle about 120°.
Basal parting frequent.
Greenish black to black.
Fuses 4–4.5 quietly to a shiny black glass. Hornblende = 3–4 with slight intumescence.
Occ. In basalt, gabbro, limestone, etc.
D. 390. M. & P. 386.

AVENTURINE. Quartz (q.v.) spangled with scales of mica, hematite, or goethite.

AXINITE. **Aluminium calcium boro-silicate with some iron and manganese, $HCa_2Al_2BSi_4O_{16}$. Fe, Mn = Ca.**

Massive curved lamellar, granular, and sharp-edged triclinic crystals.

H. 6.5–7.

Fuses at 2 with intumescence to a colored glass.

Green flame with boron flux.

Occ. Contact product on border of diabase and granite; with garnet, tourmaline, albite, quartz, etc.

D. 441. M. & P. 408.

AZURITE. **Copper carbonate, $2CuCO_3.Cu(OH)_2$.**

Blue carbonate of copper, usually in rough monoclinic crystals or massive earthy.

Deep to smalt blue.

H. 3.5–4.

Effervesces in acids. Linarite does not.

Occ. With malachite and other copper minerals as alteration product.

D. 365. M. & P. 290.

BALAS RUBY. See Spinel.

BARITE. **Barium sulfate, $BaSO_4$.**

Massive, cleavable, fibrous, or in orthorhombic tabular or prismatic crystals.

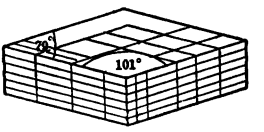

FIG. 3.—Cleavage form showing basal and prismatic cleavages and direction of cleavage rifts.

Cleavage, basal perfect, prismatic imperfect.

Sp.Gr. 4.45. High for non-metallic minerals.

Insoluble in acids.

Yellowish-green flame. Celestite = crimson.

Occ. In veins and nodules with ores of lead.

D. 524. M. & P. 319.

BASAL PINACOID. See Base.

BASALT. Medium to coarse-grained, dark-colored igneous rock composed of labradorite, augite, and olivine, the latter frequently as phenocrysts.

Field Definition. All dark-colored aphanitic igneous rock without phenocrysts, that with phenocrysts being called melaphyre.

BASE OR BASAL PINACOID. A crystal form consisting of two faces parallel to the lateral axes. See Tetragonal, Hexagonal, Orthorhombic, Monoclinic, and Triclinic.

BAUXITE. **Aluminium hydrate, $Al_2O(OH)$.**

Massive, pisolitic, spongy, clay-like, and fine-grained compact.

Clay odor.

Pisolitic structure. This is not common in clay.

H. 1–3.

Infusible.

Yields water in CITb. at high heat.

May become magnetic, owing to replacement of Al by Fe.

Occ. With clay, etc.

D. 350. M. & P. 346.

B.B. Before blowpipe.

BELL-METAL ORE. See Stannite.

BERYL. **Beryllium aluminium silicate, $Be_3Al_2(SiO_3)_6$.**

Massive, columnar, and simple hexagonal prisms and base.

Common: blue, bluish, yellow.

Emerald: emerald-green.
Aquamarine: sea-green to bluish green.
H. 7.5–8. Apatite = 5; Quartz = 7; Tourmaline = 7–7.5.
Indistinct basal Cv. Topaz = basal perfect.
Occ. In granite pegmatite, mica schist, etc., with quartz, feldspar, micas, and garnet.
D. 405. M. & P. 391.

BIOTITE. Iron magnesium mica, $(HK)_2(Mg.Fe)_2Al_2(SiO_4)_3$.
Disseminated micaceous scales or crystals and in nodular aggregates.
Basal cleavage eminent.
Black to green, dark even in thin sheets.
H. 2.5–3.
Tough and elastic.
Fuses with difficulty (5).
Occ. Especially in granite and mica schists.
D. 467. M. & P. 418.

BISMUTH. Native element, Bi.
Massive, reticulated, and embedded lenticular crystals.
Metallic.
Reddish white to light copper-red.
H. 2–2.5. Niccolite = 5–5.5.
Basal cleavage perfect.
Sp.Gr. 9.7.
Fuses at 1, volatilizes.
Occ. Crystals or grains in quartz.
D. 275. M. & P. 267.

BISMUTHINITE. Bismuth sulfid, Bi_2S_3.
Usually massive, foliated or fibrous, rarely acicular orthorhombic crystals.
Side pinacoidal Cv. per.
Lead-gray to tin-white, with yellowish or iridescent tarnish.
H. 2.
Fuses at 1.

Chemical tests are necessary to distinguish from Stibnite.
D. 284. M. & P. 268.

BLACK HEMATITE. See Psilomelane.

BLACK JACK. See Sphalerite.

BLACK LEAD. See Graphite.

BLACK MICA. See Biotite.

BLACK OXID OF COPPER. See Tenorite.

BLACK OXID OF MANGANESE. See Pyrolusite.

BLACK SAND. A residual product derived principally from the basic rocks, prevailingly black in color. May contain, e.g., Chromite, Garnet, Gold, Ilmenite, Magnetite, Monazite, Platinum, Rutile, Zircon, etc.

BLENDE. See Sphalerite.

BLOWPIPE FLAMES. Two kinds of flames may be obtained with the blowpipe, oxi-

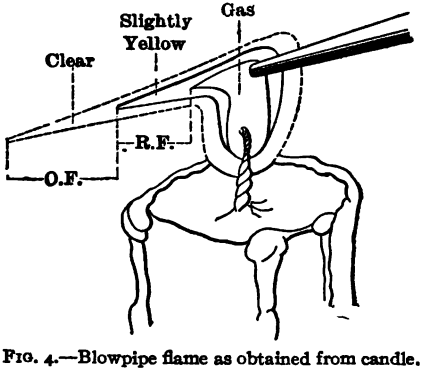

FIG. 4.—Blowpipe flame as obtained from candle.

dizing O.F. and reducing R.F.; the former tends to add oxygen to substances heated

in it, while the latter tends to abstract oxygen. The former forms oxids and the latter in some cases reduces oxids, etc., to elements.

BLUE CARBONATE OF COPPER. See Azurite.

BLUE IRON EARTH. See Vivianite.

BLUE VITRIOL See Chalcanthrite.

BOG-ORE. See Limonite.

BORACITE. Magnesium borate, $Mg_7Cl_2B_{16}O_{30}$.

Cube, tetrahedron, octahedron, dodecahedron, and combinations of same as isolated crystals and massive.

White, tinted gray, yellow, green.

H. Crystals 7, massive 4.5.

Fuses at 1 with intumescence to white glass, colors flame yellowish green = B.

Occ. With halite, gypsum, anhydrite, etc., at Stassfurt, Germany.

D. 518. M. & P. 359.

BORNITE. Copper iron sulfid, Cu_3FeS_3.

Massive, granular, and compact, rarely in cubic crystals.

H. 3.

Peculiar red-brown on fresh surface, tarnishing purple quickly. Chalcocite = gray, tarnishing blue to black.

On charcoal fuses 2.5, sulfur dioxid, black globule magnetic on cooling. Chalcocite does not become magnetic.

Occ. With other copper sulfids, especially chalcocite and chalcopyrite.

D. 297. M. & P. 284.

BORAX. Sodium biborate, $Na_2B_4O_7 + 10H_2O$.

Massive, earthy, and glassy monoclinic crystals, altering to white or grayish mass.

H. 2–2.5. Brittle.

Sweetish alkaline taste.

With boron flux yields a clear green boron flame.

Occ. Crystals in saline muds and as surface efflorescence.

D. 520. M. & P. 356.

BORONATROCALCITE. See Ulexite.

BORON FLUX. A mixture consisting of 3 parts potassium bisulfate, $HKSO_4$, and 1 part of fluorite, CaF_2, both finely powdered.

Three parts of this mixture with one of the assay will assist in obtaining the boron flame (yellowish green, momentary) from compounds of the element.

BOTRYOIDAL. Globular mineral masses packed closely together like a bunch of grapes.

BOURNONITE. Lead copper sulfur antimonid, $(Pb,Cu_2)_3Sb_2S_6$.

Massive, fine-grained, and in thick tabular crystals, usually twinned.

Nearly black to steel-gray. Galenite is lighter colored and has per. cubic cleavage.

H. 2.5–3. Tetrahedrite = 3–4.5.

Occ. With galena, sphalerite, and tetrahedrite in argentiferous veins.

D. 310. M. & P. 258.

BRIMSTONE. See Sulfur.

BRITTLE. A mineral that flies apart or breaks readily when struck with a hammer.

BRITTLE SILVER ORE. See Stephanite.

BROCHANTITE. Hydrous copper sulfate $Cu_4(OH)_6SO_4$.

Acicular orthorhombic prisms, vertically striated, drusy crusts, reniform masses.

Side pinacoidal Cv. per.

Emerald-green to dark green.

H. 3.5–4. Brittle.

Closed tube, water and H_2SO_4 turns black.
Fuses at 3.5, reduces to metallic copper.
Soluble in HCl without effervescence. Malachite effervesces.
Occ. With malachite and native copper.
D. 530. M. & P. 289.

BRONZE MICA. See Phlogopite.

BRONZITE. Magnesium silicate with some iron, $(Mg,Fe)SiO_3$.
Orthorhombic pyroxene.
Massive, reticulated, and columnar.
H. 5–6.
Very prominent prismatic and brachypinacoidal Cv.
Bronze lustre, bronze-brown.
Fuses with difficulty at 6.
Occ. Especially in gabbros and peridotites.
D. 385. M. & P. 384.

BROOKITE. Titanium oxid, TiO_2.
Orthorhombic brown transparent thin or tabular, and in black opaque untwinned crystals.
Stk. Pale yellow to grayish brown.
Insoluble in acids.
Infusible.
Occ. In quartz veins often with octahedrite.
D. 347. M. & P. 252.

BROWN HEMATITE. See Limonite.

BRUCITE. Magnesium hydrate, $Mg(OH)_2$.
Massive, fibrous, and foliated.
Pinacoidal Cv. per. Gypsum = 2 transverse Cvs. in addition.
H. 2.5. Talc = 1; Gypsum = 2.
Flexible, sectile to brittle. Muscovite = elastic.
Soluble in HCl. Talc is insoluble.
Infusible.

Occ. With magnesite and dolomite in serpentine.

D. 351. M. & P. 340.

CALAMINE. Hydrated zinc silicate, $(ZnOH)_2SiO_3$.

Sheaf-like aggregates resembling those of prehnite; also granular and drusy.

H. 4.5–5. Prehnite = 6–6.5; Cerussite = 3–3.5.

Prismatic cleavage sometimes prominent.

Gelatinizes in dilute HCl.

Yields water in closed tube. Willemite does not.

Fsy. + 5 to infusible. Stilbite = 2.5 to white enamel.

Occ. With clay and smithsonite as alteration product of zinc ores.

D. 446. M. & P. 246.

CALAVERITE. Gold tellurid, $AuTe_2$.

Steel-gray to pale yellow in tiny arborescent veins and rarely in crystals.

H. 2.5. Pyrite and marcasite = 6.

Brittle. Gold is sectile.

Fuses at 1, yielding yellow globules of Au.

Cleavage lacking. Sylvanite = pinacoidal per.

Occ. Often in gray phonolite with fluorite; also in schist.

D. 305. M. & P. 306.

CALCITE. Calcium carbonate, $CaCO_3$.

Yellowish-white to colorless, usually transparent crystals. Rhombohedrons, scalenohedrons, etc. Massive, cleavable to granular.

Perfect rhombohedral Cv. (3 directions equally inclined to vertical axis). Aragonite has 1 Cv. direction only. (See cut, p. 18.)

H. 3. Other carbonates = + 3.

Sp.Gr. 2.7. Other carbonates are higher.

Effervesces easily in lumps in cold dilute HCl. Dolomite does so only in powder.

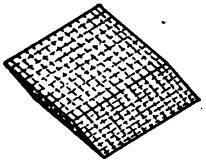

FIG. 5.—Cleavage rhombohedron cross-lined to show direction of cleavage rifts.

Occ. In all limestone regions and in veins in all rocks.
D. 354. M. & P. 306.

CALCSPAR. See Calcite.

CAPILLARY. Hair-like crystals.

CAPILLARY PYRITES. See Millerite.

CARNALLITE. Hydrous potassium magnesium chlorid, $KMgCl_3+6H_2O$.
Massive, somewhat granular, rarely in crystals.
Milk-white, brownish, reddish.
Bitter taste.
Very deliquescent.
Cleavage lacking.
Occ. In beds at Stassfurt salt deposits, Germany.
D. 323. M. & P. 310.

CARNELIAN. Blood-red or brownish-red Chalcedony, q.v.

CARNOTITE. Impure uranyl vanadate, containing Radium (?).
Ocher-like and sandy.
Canary-yellow.
Occ. Impregnation in sandstones.

CASSITERITE. Tin oxid, SnO_2.

Brown to reddish-black adamantine tetragonal crystals; also dull imitative masses and concentric pebbles.

1. **H. 6.5.** Sphalerite = 4.
2. **Sp.Gr. 6.9.**
3. **Cleavage lacking.**
4. **Infusible.**
5. **Insoluble in HCl.**
6. **Tin reactions.** Tourmaline reacts for boron. 3 to 6 distinguish it from Wolframite, and 2 and 3 from the silicates it resembles.

Occ. In pegmatites and granite contacts with fluorite, etc.

D. 344. M. & P. 249.

CAT'S-EYE. A fibrous grayish-brown asbestos replaced in part by quartz.

CELESTITE. Strontium sulfate, $SrSO_4$.

Massive, cleavable, fibrous, granular, and simple orthorhombic crystals.

Cv. **Basal perfect. Prismatic imperfect.**

White, pale blue, or red.

Sp.Gr. 3.96. Higher than most light-colored minerals.

Crimson flame. Barite = yellowish green.

Occ. In cavities in limestone, marl, and sandstone with gypsum and sulfur.

D. 526. M. & P. 321.

CERARGYRITE. Silver chlorid with some bromid or iodid, Ag(Cl,Br,I).

Soft **horn-like crust,** rarely in cubic crystals.

Pearl-gray or greenish, darkening on exposure to violet-brown, dark gray, or black.

H. 1–1.5.

Cuts like wax.

Insoluble in HNO_3. Argentite is soluble in HNO_3, with separation of sulfur.

Soluble in NH_4OH.

Occ. With silver ores.

D. 319. M. & P. 301.

CERUSSITE. Lead carbonate, $PbCO_3$.

Massive, fibrous, stalactitic, granular, earthy, and six-rayed stellate twin groups of orthorhombic crystals.

Sp.Gr. 6.5. High for carbonates.

Adamantine luster on crystals.

Cream, white.

Effervesces in warm dilute HCl. Anglesite does not.

Fuses at 1.5 in R.F. and yields globule of Pb.

Occ. With and derived from galena; also with anglesite and pyromorphite.

D. 363. M. & P. 262.

CHABAZITE. Hydrous calcium aluminium silicate with some sodium and potassium, $(Ca(Na_2,K_2))Al_2(SiO_3)_4+6H_2O$.

Almost cubic crystals striated parallel to edges.

85° rhombohedron. Twins look like twin-cubes of fluorite.

H. 4–5. Calcite = 3.

Does not effervesce in HCl, but is soluble, with residue of flakes and lumps of jelly.

Intumesces, fuses 3.5 to blebby glass nearly opaque. Analcite = 2.5 to colorless glass.

Occ. In amygdules and fissures in basaltic rock with stilbite, apophyllite, etc.

D. 458. M. & P. 414.

CHALCANTHRITE. Hydrous copper sulfate, $CuSO_4.5H_2O$ (Blue vitriol).

Flat triclinic crystals, massive, fibrous, stalactitic, botryoidal, crusts.

Sky-blue to greenish blue.

Metallic nauseating taste.

B.B. fuses 1, colors flame green.

Easily soluble in water to blue solution.

Occ. With chalcopyrite and other sulfids of copper as an oxidation product.

D. 534. M. & P. 289.

CHALCEDONY. Silicon dioxid, SiO_2.
Massive amorphous silica; in variously colored layers called agate.
Conchoidal fracture.
Wax-like luster.
H. 7.
Never in crystals.
Occ. In amygdules and veins in igneous rocks.
D. 326. M. & P. 372.

CHALCOCITE. Cuprous sulfid, Cu_2S.
Massive, granular, compact, and rarely in orthorhombic crystals.
Dull steel- or lead-gray, tarnishing blue-green or black. Bornite = peculiar reddish brown with purple tarnish.
H. 2.5–3. Brittle. Argentite = sectile.
Occ. With other Cu minerals, hematite, galena, etc.
D. 290. M. & P. 283.

CHALCOPYRITE. Copper, iron sulfid, $CuFeS_2$.
Usually massive but sometimes in tetragonal sphenoids, etc.
H. 3.5–4. Brittle. Pyrite = 6. Gold = 3. and is sectile.
Brass-yellow, tarnishing blue or purple iridescent.
Greenish-black streak. Gold = yellow.
On charcoal, scintillates, brittle magnetic globule (cold) which if touched with HCl = blue copper flame.
Occ. With metallic sulfids of copper and iron ores.
D. 297. M. & P. 284.

CHALCOTRICHITE. Hair-like crystals of Cuprite, q.v.

CHERT. A rock composed of impure chalcedony, tough, compact, and with splintery fracture, usually associated with limestone.

CHIASTOLITE. Aluminium silicate, Al_2SiO_5.

A variety of andalusite showing black squares or crosses of carbonaceous matter in end sections.

H. 7.5. Fresh; gray, reddish. 2–4, weathered; dark gray, blackish gray.

Occ. In knotted schists.

D. 433. M. & P. 404.

CHILI SALTPETER. See Soda Niter.

CHINA CLAY. See Kaolinite.

CHLOANTHITE. Nickel arsenid with cobalt, $(Ni,Co)As_2$.

See Smaltite.

CHLORITE. Silicate of Fe.Mg.Al + about 12% H_2O, $H_8Mg_5Al_2Si_3O_{18}$—Fe iso.w. Mg and Al.

Fine to coarse scales, pigmental, six-sided crystals and earthy granular.

H. 1.5–2.5. Tough to brittle.

Basal cleavage.

Flexible to slightly elastic. Micas = elastic.

Generally dark green.

Reacts for Al. Talc does not.

Fsy. 4 to black magnetic, to 6 to yellow enamel.

Occ. Manywhere, by alteration of micas, aluminous amphiboles, pyroxenes, garnet, feldspars, etc., earthy in cavities in schists and serpentine.

D. 472. M. & P. 419.

CHONDRODITE. Magnesium fluo-silicate, $(Mg(FOH))_2Mg_3(SiO_4)_2$—Fe iso.w. Mg.

Massive, granular, and in monoclinic pseudo-orthorhombic crystals.

Brownish red to yellow.

H. 6–6.5. Tourmaline = 7. Spinel = 8. Apatite = 5. Nephelite = 5–5.5 and has a greasy luster and reacts for Na.

Infusible. Vesuvianite = 3. Garnet = +3.

Gelatinizes with dilute HCl and solution reacts for Mg.

Occ. In crystalline limestone, etc., with spinel, biotite, pyroxene, chlorite, magnetite, vesuvianite, etc.

D. 443. M. & P. 409.

CHROME MICA. See Muscovite.

CHROMIC IRON. See Chromite.

CHROMITE. Iron chromate, $FeCr_2O_4$.

Massive, fine granular to compact, rarely in octahedral crystals.

Pitchy luster.

Sometimes feebly magnetic. Magnetite is strongly.

Stk. Light brown. Franklinite = dark brown. Spinel = colorless.

H. 5.5. Spinel = 8.

Occ. In peridotite and serpentine, in meteorites, and black sand.

D. 341. M. & P. 224.

CHRYSOBERYL. Beryllium aluminate, $Be(AlO_2)_2$.

Orthorhombic crystals pseudo-hexagonal by twinning.

H. 8.5. Topaz = 8.

Infusible.

Tabular crystals. Beryl = prismatic.

Occ. In pegmatite with tourmaline, garnet, and apatite.

D. 342. M. & P. 353.

CHRYSOCOLLA. Copper silicate, $CuSiO_3.2H_2O$.

Massive, opal-like crusts, and earthy, never crystallized.

Green to light blue.

H. 3. Turquois and Opal = 6. Garnierite = 1–2.

Infusible, turns black instantly, reacts for Cu.

Soluble in dilute HCl with residue of silica without effervescence. Malachite effervesces and is fibrous.

Occ. Alteration product of other copper minerals, especially with cuprite, azurite, and malachite in upper portion of Cu-bearing veins.

D. 483. M. & P. 291.

CHRYSOPRASE. Apple-green Chalcedony, q.v.

CINNABAR. Mercury sulfid, HgS.

Massive, granular, earthy, compact, and crystals.

Scarlet, cochineal, and red-brown.

Scarlet streak. Cuprite and hematite = red-brown. Realgar = orange-yellow.

Sp.Gr. 8. High for non-metallic mineral.

H. 2–2.5. In matrix may appear much harder.

Volatilizes at 1.5 if pure. Proustite = 1 with garlic odor and residue of silver.

Occ. In veins or impregnations in shales and sandstones with sulfids of iron.

D. 293. M. & P. 294.

CLOSED TUBE. Cl.Tb. A hard glass tube, 3 inches long, about $\frac{1}{8}$ inch in diameter, fused together at one end. A small amount of the mineral is heated in this gradually to a red heat and results may be looked for, as decrepitation, fusion, change of color, sublimates condensing on the cold walls either solid, e.g., sulfur, or in drops, e.g., mercury, or water which may be neutral or acid.

CLEAVAGE. A capacity for easy separation of a mineral parallel to certain crystal planes yielding surfaces which are called **cleavage faces.** These usually differ from crystal faces in their step-like appearance. The cleavage planes of a mineral may all be alike (parallel to one crystal form) or fall into groups showing unlike qualities. They vary in number and inclination to

each other with the system in which the mineral crystallizes.

They may be developed by tapping the mineral with the edge of a light hammer in line with their direction.

A cleavage surface may be **perfect** or **eminent**, yielding fine reflections of distant objects when held close to eye, **distinct, indistinct, poor,** or **interrupted** and in **traces.**

It may be obtained easily or with difficulty.

Isometric System.

Cubic, 3 directions of like perfection. Galena, Halite, q.v.

Octahedral, 4 directions of like perfection. Diamond, Fluorite, q.v.

Dodecahedral, 6 directions of like perfection. Sphalerite, q.v.

Tetragonal System.

Basal, 1 direction. Apophyllite = pearly.

Prismatic, 2 directions, at right angles to base. Scapolite, Rutile.

Hexagonal System.

Basal, 1 direction. Graphite, Molybdenite.

Rhombohedral, 3 directions equally inclined to the vertical axis and not at right angles to each other. Calcite, q.v.

Orthorhombic System.

Basal, 1 direction. Topaz, Barite (q.v.), perfect.

Prismatic, 2 directions at right angles to base. Barite, fair; Celestite.

Side pinacoidal, 1 direction. Stibnite, Sillimanite.

Monoclinic System.

Basal, 1 direction. Micas, Orthoclase, q.v.

Side pinacoidal, 1 direction at right angle to base. Orthoclase, q.v.

Prismatic, 2 directions of like perfection. Amphiboles.

Triclinic System.

Basal, 1 direction, distinguished from the other basal by striations and re-entrant angles. Plagioclase, q.v.

Side pinacoidal, 1 direction nearly at right angles to base. Plagioclase, q.v.

CLINOCHLORE. See Chlorite.

CLINOHUMITE. A magnesium fluo-silicate, $Mg_7(Mg(F,OH))_2(SiO_4)_4$.

Monoclinic, occurring with and resembling Chondrodite, q.v.

CL.TB. See Closed Tube.

COAT. A sublimate produced upon heating some minerals B.B. in O.F. or R.F. upon a support, e.g., charcoal.

COBALTITE. Cobalt sulf-arsenid, CoAsS.

Octahedrons and pyritohedrons, and massive granular to compact.

Silver-white, steel-gray with pink tarnish.

Fuses 2–3, white fumes with garlic odor, magnetic globule which will react for Co in borax bead.

Soluble in warm dilute HNO_3 to rose-red solution with separation of S and arsenious oxid.

Occ. In metamorphic limestone with chalcopyrite and in veins with Ag and Bi minerals.

D. 301. M. & P. 234.

COBALT GLANCE. See Cobaltite.

COBALT PYRITES. See Linnaite.

COLEMANITE. Hydrous calcium borate, $Ca_2B_6O_{11}+5H_2O$.

Complex glassy monoclinic crystals; massive, platy, cleavable, granular, and compact.

Side pinacoidal Cv. prominent into thin plates.

H. 4–4.5. Topaz = 8. Apophyllite = 5–6.

Colorless, white, yellowish.
Boron flame.
Insoluble in water but easily soluble in hot dilute HCl.
Occ. In beds interstratified with saline lake sediments, with borax, etc., occasionally in geodes.
D. 519. M. & P. 357.

COLOR, C. The color of a mineral is described in the ordinary names with the addition of certain familiar object colors which are fairly constant, e.g., lemon-yellow, etc.
The color of minerals depends frequently on the presence of impurities and is therefore of little value as a character except in the case of those minerals with a metallic luster. **Manycolor** is introduced as a term to indicate that the color of a mineral is varied and cannot be relied on.

COLUMBITE. Iron manganese tantalocolumbate, $(Fe,Mn)(Cb,Ta)_2O_6$.
Orthorhombic crystals usually in parallel groups; also massive.
Poor cleavage. Wolframite = perfect.
Pitch-black. Tourmaline = triangular in cross-section.
H. 6. Brittle.
Sp.Gr. 5.3–7.3.
Indistinguishable from Cassiterite by inspection.
Occ. In granite, with albite, tourmaline, beryl, etc.
D. 490. M. & P. 225.

COLUMNAR. A parallel or nearly parallel grouping of prisms or columns, e.g., beryl.

COMBINATION. Two or more crystal forms present on the same crystal, e.g., cube and octahedron on galena.

COMPACT. A mineral mass, of exceedingly minute particles, free from cavities.

CONCHOIDAL. Showing a curved shell-like surface.

COPPER. Native element, Cu.

Crystallized, usually indistinct forms. massive, in sheets and small grains.

Hackly fracture with prickly feel.

Malleable and ductile.

Shiny copper-red streak. Niccolite = brownish black. Tarnished Ag = silver-white.

Occ. With native silver and copper minerals.

D. 2.78. M. & P. 282.

COPPER GLANCE. See Chalcocite.

COPPER PYRITES. See Chalcopyrite.

COPPER NICKEL. See Niccolite.

CORDIERITE. See Iolite.

CORUNDUM. Aluminium oxid, Al_2O_3.

Massive, cleavable, granular, coarse or fine and in barrel-shaped crystals.

Rhombohedral parting, angle 86° nearly cubic.

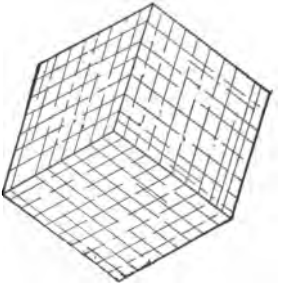

FIG. 6.—Parting rhombohedron showing striations parallel to edges.

Striations.

H. 9.

Occ. In crystalline rocks with chlorite,

margarite, spinel, magnetite, diaspore, etc.
D. 333. M. & P. 346.

COVELLITE. Cupric sulfid, CuS.
Massive, platy, spheroidal with crystalline surface, rarely in hexagonal prisms horizontally striated.
Indigo-blue.
Basal cleavage perfect
H. 1.5–2. Chalcocite = 2.5–3.
On charcoal burns with a blue flame, SO_2, non-magnetic globule.
In closed tube yields sublimate of S. Chalcocite does not.
Occ. With other copper minerals.
D. 294.

CROCIDOLITE. A blue to green fibrous amphibole.

CRYOLITE. Sodium aluminium fluoride, Na_3AlF.
Massive **icelike.**
Vitreous to weak vit. luster.
H. 2.5.
Pseudo-cubic Cv. developed to varying degree, sometimes only a rough ribbing.
Fuses at 1.5 (in candle-flame).
Occ. With siderite, small amounts of chalcopyrite and galenite.
D. 321. M. & P. 346.

CRYSTAL AXES. Arbitrary co-ordinate directions selected when possible with reference to symmetry elements of crystals. See Isometric, Tetragonal, Hexagonal, Orthorhombic, Monoclinic, and Triclinic.

CRYSTAL FORM. All the planes on a crystal bearing the same relation to like axes.

CRYSTALLINE. A mineral is crystalline when it possesses a regular internal structure which may be evidenced by crystal form, cleavage, optical properties, etc.

It is further said to be **crystallized** when the crystals are individual and **massive** when the crystals interfere with each other, preventing complete development of the individual.

CUBE. See Isometric, Argentite, Galena, Fluorite.

CUBE-LIKE. See Alunite, Apophyllite, Chabazite, Corundum Cv.

CUPRITE. Cuprous oxid, Cu_2O.

Massive, fine-grained, earthy, and in octahedrons, cubes, and dodecahedrons.

Dark red.

Stk. Brownish, red, brick-red.

H. 3.5–4. Hematite = 6. Proustite = 2.5.

Colors flame emerald-green and in F.F. yields malleable copper.

Occ. With limonite, copper minerals, and quartz.

D. 331. M. & P. 288.

CURVILAMINAR. Masses of curved separable plates.

Cv. Cleavage, q.v.

CYANITE. Aluminium silicate, Al_2SiO_5.

Long triclinic knife-blade-like divergent crystals.

Infusible.

H. 5 lengthwise, 7 crosswise of same crystal.

Faded blue or greenish.

Cleavage faces wavy or bent with much cross parting.

Occ. In gneiss and mica schist with staurolite, pyrophyllite, andalusite, corundum, etc.

D. 434. M. & P. 392.

D. Page references to Dana's "A Textbook of Mineralogy," 1898–1905 editions, published by John Wiley & Sons, New York City.

DARK RUBY SILVER. See Pyrargyrite.

DATOLITE. Calcium boro-silicate, $Ca(BOH)SiO_4$.

Unglazed porcelain-like masses and complex glassy crystals.

H. 5–5.5.

Crystals usually tinged with green.

Fuses at 2 with intumescence to a clear glass.

Yellowish-green flame (momentary). Zeolites show a yellow flame.

Occ. Secondary in igneous rocks in veins with zeolites, prehnite, and calcite.

D. 435. M. & P. 405.

DECREPITATE. Snap to pieces when heated B.B.

DEFINITIONS. The definitions are limited to those demanded by the descriptive notes.

DELIQUESCENT. Having a tendency to absorb moisture from the air and thus form a solution.

DENDRITIC. Fern- or tree-like tracings of a mineral, e.g., pyrolusite.

DIABASE. All igneous rock occurring in dikes or sheets composed essentially of plagioclase, augite, and magnetite, with or without olivine and possessing a texture called ophitic or **diabasic,** in which lath-shaped feldspar crystals form a network, the interstices of which are filled with the augite, etc.

DIALLAGE. Thin foliated green or brown Pyroxene, q.v.

DIAMOND. Native carbon, C.

Very hard rounded crystals with **oily** luster; also massive and opaque.

H. 10.

Many colors.

Occ. With gold, platinum, in river diggings; in flexible sandstones and con-

glomerates, and basic igneous rocks; e.g., eclogite and peridotite.

D. 271. M. & P. 366

DIASPORE. Aluminium hydroxid, AlO(OH).

Thin, flat orthorhombic prisms; also needle-like, and massive foliated or thin scales

H. 6.5–7. Hornblende = 5–6.

Side pinacoidal cleavage perfect, pearly.

Decrepitates rapidly and yields water in closed tube.

Occ. With corundum, emery, and margarite.

D. 348. M. & P. 349.

DIOPSIDE. Magnesium calcium silicate, $MgCa(SiO_3)_2$.

Square prisms with side and front pinacoids and oblique base (monoclinic).

White to green.

Usually prominent basal parting.

Fuses quietly at 4. Scapolite = 3, with intumescence to glass containing bubbles.

H. 5.5–6.5. Apatite = 5, and is hexagonal.

Occ. In metamorphic limestone with garnet, and with feldspar, chlorite, and magnetite in igneous rocks.

D. 388. M. & P. 386.

DIORITE. Igneous rock composed predominately of plagioclase, and one or more members of the biotite, amphibole, and pyroxene family.

Field Definition. All granular igneous rock with dominant hornblende and subordinate feldspar of any kind.

DODECAHEDRON. See Isometric, Analcite, Garnet, Leucite.

DOLOMITE. Calcium magnesium carbonate, $(Ca,Mg)CO_3$.

Massive, granular, and in curved **saddle-shaped** crystals with **scaly** surfaces.

H. 3.5–4. Calcite = 3.
Effervesces in powder only in cold dilute HCl. Calcite effervesces freely in masses.
Does not become magnetic on heating B.B. Siderite and ankerite do.
Occ. In many limestone regions.
D. 357. M. & P. 335.
Dolomite (Rock). A magnesian limestone having nearly the same composition as the above mineral.

DOME. A crystal form parallel to but one of the unlike lateral axes and cutting the vertical axis. See Orthorhombic, Monoclinic, and Triclinic.

DRUSY. A sandpaper-like mineral surface due to a coating of minute crystals.

DRY-BONE. See Smithsonite.

EFFLORESCENCE. A powdery mineral or a crystalline coating formed by surface evaporation of mineral-bearing solutions.

ELÆOLITE. See Nephelite.

ELASTIC. A mineral is elastic when thin sheets or splinters spring back to position on being displaced.

ELECTRIC CALAMINE. See Calamine.

EMBOLITE, **Ag(Cl,Br)**. See Cerargyrite.

EMERALD. See Beryl.

EMERY. See Corundum.

ENARGITE. Copper sulfarseniate, Cu_3AsS_4.
Massive, columnar or granular, rarely in orthorhombic prismatic crystals.
Prismatic Cv. prominent. Tetrahedrite and Tennantite lack this.
Grayish black to black.
H. 3. **Brittle.**
Fuses at 1, white fumes with garlic odor, non-metallic globule which yields green flame on heating after touched with HCl.
Soluble in dilute HNO_3.

Occ. With chalcocite, bornite, famatinite, and with arsenates derived from it by alteration.

D. 315. M. & P. 286.

ENSTATITE. Magnesium silicate, $MgSiO_3$. Orthorhombic pyroxene.

Massive, bladed, laminated, and columnar.

Brown, gray, green, yellow.

Cv. Prismatic and side pinacoidal (fibrous).

Silky to bronzy luster.

H. 5.5. Softer by alteration.

Practically infusible.

Occ. In basalt and granular eruptives with magnetite. Alters to serpentine.

D. 384. M. & P. 384.

EPIDOTE. Calcium aluminium silicate, Fe iso.w. Ca and Al. $Ca_2(Al,OH)Al_2(SiO_4)_3$.

Massive, granular, radiating, and prismatic crystals striated vertically.

Pistacio-green.

Monoclinic crystals prismatic parallel to right to left axis with basal Cv. distinct. Amphiboles have prismatic form or Cv. 2 directions parallel to vertical axis.

H. 6–7.

Fuses 3–3.5 to a brown or black infusible slag, usually magnetic. Chrysolite is infusible.

Occ. Metamorphic product of feldspar, pyroxene, amphibole, and biotite. In quartz and schists.

D. 438. M. & P. 406.

ERYTHRITE. Hydrous cobalt arsenate, $Co_2As_2O_8+8H_2O$.

Earthy crusts, rarely in monoclinic prismatic translucent crystals.

Peach-red to crimson.

Soft, 1–2.5. Sectile.

Flexible in thin laminæ.

Side pinacoidal Cv. per.

Fuses 2.5, white fumes with garlic odor, magnetic residue.

Soluble in dilute HCl to rose-red solution.

Occ. With cobalt minerals as alteration product called **cobalt bloom.**

D. 509. M. & P. 236.

EXFOLIATE. To expand in a way similar to the opening of a fan, as some minerals do when heated before the blowpipe, e.g., Stilbite, Pyrophyllite.

FALSE TOPAZ. Light-yellow Quartz, q.v.

FAMATINITE. **Copper sulfarseno-antimonate, Cu_3SbS_4.**

Gray tinged with copper-red.

Isomorphous with Enargite, q.v.

FEATHER ORE. See Jamesonite.

FELDSPARS. Prominent rock-forming minerals, either monoclinic or triclinic.

Prism angle = nearly 120°.

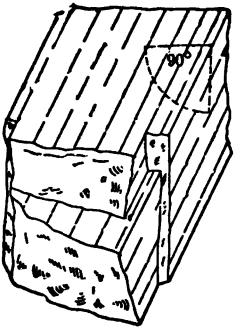

FIG. 7.—Fragment of Orthoclase showing the cleavage surfaces and rifts.

Basal and side pinacoidal cleavages at or about 90° to each other.

H. 6–6.5.

See Orthoclase, Microcline, Plagioclase, Albite, Labradorite, and Oligoclase.

FELDSPATHOIDS. A group of minerals having the same chemical constituents as the feldspars but with a smaller percentage of silica. See Leucite, Nephelite, and Sodalite.

FIBROLITE. See Sillimanite.

FILIFORM. Thread- or wire-like crystals.

FLEXIBLE. A mineral is flexible when thin layers or splinters may be slightly bent out of position without fracturing.

FLINT. Smoky to dark gray nodules of silica, somewhat like chalcedony, but more opaque, occurring in chalk-beds.

FLOS FERRI. See Aragonite.

FLUORITE. **Calcium fluorid, CaF_2.**

Massive, granular, fibrous, banded, and in cubic crystals.

Cubic crystals twinning on the plane of the octahedron.

Perfect octahedral Cv.

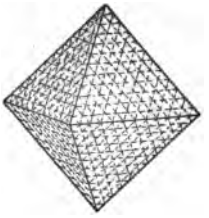

FIG. 8.—Cleavage octahedron, cross-lined to show directions of the cleavage rifts.

H. 4. Calcite = 3.

Occ. Alone in veins and as gangue of lead, silver, copper, and tin ores.

D. 320. M. & P. 325.

FLUOR SPAR. See Fluorite.

FOLIATED. A mineral mass consisting of easily separable plates, e.g., brucite, talc.

FOOL'S GOLD. See Pyrite and Phlogopite.

FRACTURE, Frt. When a mineral breaks other than on a cleavage or parting plane.

Varieties: **Conchoidal**, curved shell-like. **Uneven**, rough. **Hackly**, jagged. **Splintery**, yielding splinters.

FRANKLINITE. **Iron manganese zinc oxid, $(Fe,Mn,Zn)O.(Fe,Mn)_2O_3$.**

Crystals, octahedron modified by dodecahedron. Massive, granular, compact.

Slightly to strongly magnetic.

Brown Stk. Magnetite = black.

H. 6.

May react for zinc and manganese.

Occ. With zincite and willemite in limestone.

D. 341. M. & P. 217.

FRENCH CHALK. See Talc.

FRONT PINACOID. A crystal form parallel to the right to left and the vertical axes. See Orthorhombic, Monoclinic, Triclinic.

FRT. Fracture, q.v.

FUSIBILITY, Fsy. The approximate degree of fusibility of a mineral may be determined by heating a small sharp-pointed fragment about the size of a pin-point in the candle- or the blowpipe-flame. This may fuse easily, with difficulty, or be apparently infusible in the candle-flame. If the latter, it may fuse easily, with difficulty, or be apparently infusible in the blowpipe-flame. A finer fragment with thin edge may be found to round over in the hottest part of the flame, otherwise it is said to be infusible.

A mineral is said to have a fusibility of 3, or to fuse at 3, when it fuses with the same readiness as No. 3 of the following **Scale of Fusibility:**

1. **Stibnite.** Easily in candle-flame.
2. **Datolite.** Slowly in candle-flame.
3. **Almandite.** Easily in blowpipe-flame, only on thin edges in candle-flame.
4. **Actinolite.** Slowly in blowpipe-flame.
5. **Orthoclase.** With difficulty in blowpipe-flame. **(A test of good blowpipe-manipulation.)**
6. **Bronzite.** With extreme difficulty on thinnest edges.
7. **Calcite.** Infusible, glows and whitens.

GABBRO. Dark-colored igneous rock composed of labradorite, pyroxene, and sometimes amphibole and olivine.

Field Definition. All granular igneous rocks with dominant pyroxene and subordinate feldspar of any kind, with or without hornblende or mica.

GAHNITE. $ZnAl_2O_4$, Fe, Mn iso.w. Zn.
Zinc Spinel.
Dark green to grayish brown.
H. 7.5–8.
See Spinel.

GALENA. See Galenite.

GALENITE. Lead sulfid, PbS.
In cubic crystals or massive with cubic cleavage, rarely fine granular.
Cube, octahedron.
Cubic cleavage perfect.
Metallic. Lead-gray.
H. 2.5. Brittle. Argentite is sectile.
High Sp.Gr. 7.5. Stibnite = 4.5 and is prismatic.
On charcoal decrepitates, fuses 2. O.F. white coat. R.F. yellow coat and metallic lead.
Occ. With other sulfids, tetrahedrite, cerussite, anglesite, dolomite, calcite.
D. 287. M. & P. 256.

GARNET. $R_3''R_2'''(SiO_4)_3$ or $3R''O_1R_2'''O_3.3SiO_2$. R'' = Ca, Mg, Fe, Mn. R''' = Al, Fe, Mn, Cr, Ti.

Embedded isometric crystals, druses. Massive, compact, and granular.

Dodecahedron and trapezohedron alone and combined.

H. 6.5–7.5. Leucite = 5.5–6; Analcite = 5–5.5; Sphalerite = 3.5–4.

Fsy. +3 (**Uvarovite 7**). Vesuvianite = 3 with violent intumescence.

Sp.Gr. 3.5–3.8. Tourmaline = 2.9–3.2.

Occ. In granite, schist, gneiss, crystalline limestone with serpentine, epidote, etc.

D. 415. M. & P. 396.

GARNIERITE. Hydrous magnesium nickel silicate, $H_2(Ni,Mg)SiO_4 + H_2O$.

Amorphous, massive, rounded, pod-shaped, and earthy.

Apple-green, deep green, white with varnish-like luster.

H. 1–2. Friable. Talc = 1; Serpentine = 2.5–4.

Reacts for nickel in borax bead.

Occ. In veins with serpentine, talc, and in clay.

D. 479. M. & P. 240.

GAY-LUSSITE. $Na_2CO_3.CaCO_3.5H_2O$.

White monoclinic pyramidal crystals.

Occ. Among saline lake deposits.

GENTHITE, $Ni_2Mg_2Si_3O_{10}.6H_2O$. See Garnierite.

GERSDORFFITE, $NiAsS$. See Cobaltite.

GEYSERITE. Loose, porous rock of opaline silica deposited from hot water.

GIBBSITE. Aluminium hydrate, $Al(OH)_3$.

Massive, stalactitic, mammillary, fibrous crusts with smooth surface.

H. 3. Opal = 6.

White tinted green, red, and yellow.

Infusible, glows.

Occ. With bauxite.
D. 351. M. & P. 351.

GLAUBERITE. Sodium calcium sulfate $Na_2Ca(SO_4)_2$.
Tabular monoclinic crystals and lamellar masses.
Occ. With halite in mud of salt lakes.
D. 523. M. & P. 314.

GLAUCOPHANE. Sodium aluminium silicate, $NaAl(SiO_3)_2.FeMgSiO_3$.
A sodium amphibole in indistinct prisms, columnar and fibrous masses.
Lavender to blackish blue.
Occ. In schists.
See Hornblende.

GMELINITE, $Na_2Al_2(SiO_3)_4.6H_2O$. Same as Chabazite, with Na in place of Ca.

GNEISS. Meta-igneous or meta-sedimentary rock coarsely foliated or banded. Varieties are named from the prominent mineral constituent or from the parent rock.

GOETHITE. Iron hydroxid, FeO(OH).
Lustrous black or brown prisms, red scales, feathery and velvety crusts, radiated fibrous, foliated and imitative.
Orthorhombic. Limonite does not crystallize.
Stk. **Yellow, brownish yellow.** Hematite = red.
Bright cleavage faces.
Occ. In cavities with limonite and hematite.
D. 349. M. & P. 220.

GOLD. Native element, Au.
Scales, flakes, leaves, grains, wires, nuggets.
Golden-yellow color and streak.
H. 2.5. Sectile and malleable. Chalcopyrite is brittle and has greenish-black streak. Pyrite = 6–6.5.
Insoluble in HCl. Fuses 2.5–3.
Occ. Usually in quartz, conglomerate,

schist, with pyrite, arsenopyrite, chalcopyrite, etc.

D. 275. M. & P. 304.

GRADE OF SYMMETRY. The number and kind of symmetry features in a crystal.

GRANITE. Granular igneous rock composed essentially of orthoclase (or microcline), quartz, with minor amounts of plagioclase, biotite, muscovite, hornblende, etc.

Field Definition. All granular igneous rock composed of dominant quartz and feldspar of any kind, with mica, hornblende, or other minerals in subordinate amount.

GRAPHITE. Native carbon, C.

Soft scales, broad plates, rarely columnar and earthy.

H. 1–2. Steely hematite is harder and has a red streak.

Stk. Dark gray, will show on paper. Molybdenite = greenish gray and reacts for Mo and S.

Black to dark gray. Molybdenite is lighter in color and has a bluish tinge.

Infusible.

Occ. In veins and in crystalline limestone, etc.

D. 273. M. & P. 368.

GRAY ANTIMONY. See Stibnite.

GRAY COPPER ORE. See Tetrahedrite.

GROSSULARITE. A calcium Garnet, q.v.

GUANO. Granular to sponge-like, compact fosfatic deposits of essentially the composition of Apatite, q.v.

GYPSUM. Hydrous calcium sulfate, $CaSO_4 + 2H_2O$.

Massive, granular, compact, silky; in simple monoclinic crystals and imitative twins.

H. 2. Talc = 1; Brucite = 2.5.

Side pinacoidal Cv. per. and 2 transverse Cvs.

Soluble in HCl. Does not effervesce like calcite, nor yield silica like heulandite and stilbite.

Yields water in Cl.Tb.

Fuses at 3–3.5.

Occ. With limestone, clays, marls, and sulfur.

D. 531. M. & P. 328.

H. Hardness, q.v.

HABIT. Crystal habit is the crystal form or group of forms characteristically predominant on crystals of a mineral. It may vary with locality. Examples: prismatic habit, Stibnite, Natrolite; cubic habit, Galena; tabular habit, Barite.

HACKLY. A fracture surface made up of jagged points, e.g., copper.

HALITE. Sodium chlorid, NaCl.

Massive, granular, compact to coarse, fibrous efflorescence. Cubic crystals.

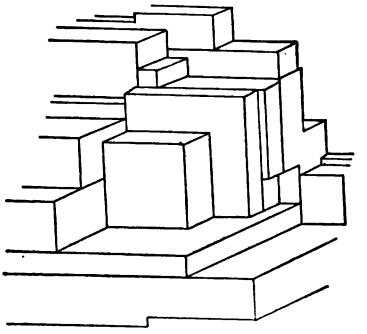

FIG. 9.—Cleavage fragment of Halite showing perfect cubic cleavage.

Salty taste.
Perfect cubic cleavage.
H. 2.5.
Completely soluble in 3 parts of cold water.

Occ. With sedimentary rocks of all ages with calcium and magnesium salts.

D. 318. M. & P. 312.

HARDNESS, H. The hardness of minerals ranges from hard to soft and is expressed in terms of the hardness of ten minerals selected arbitrarily by Mohs:

1. Talc 2. Gypsum	= Finger-nail (2.5 barely).
3. Calcite.	= Copper coin.
4. Fluorite 5. Apatite	= Knife (5.5 barely).
6. Orthoclase 7. Quartz 8. Topaz 9. Corundum 10. Diamond	Not scratched by knife.

The method of use involves scratching a fresh surface of the mineral in question with the members of the scale or their substitutes until its equivalent is found.

A mineral has the same hardness as a member of the scale when it both scratches and may be scratched by it. If a mineral is scratched by a member of the scale but does not scratch it, the mineral is half a grade lower than the member.

A true scratch cannot be rubbed off, while a "chalk" mark such as is obtained by rubbing a softer on a harder mineral can. **The two must be carefully distinguished.**

HARMOTOME. Hydrous potassium aluminium silicate, $(K_2Ba)Al_2Si_5O_{14}.5H_2O$.

Monoclinic cross-shaped penetration twins, looking like square prisms with

pyramid, feather-like striations from a medial line.

H. 4.5.

Whitens, crumbles, fuses at 3 without intumescence.

Does not gelatinize in HCl.

Occ. With stilbite.

D. 456.

HCl. Hydrochloric acid.

HEAVY SPAR. See Barite.

HEMATITE. Ferric oxid, Fe_2O_3.

Flat disk-like rhombohedral crystals; massive, granular, earthy, oölitic, columnar, imitative, sometimes friable.

Stk. Cherry-red to reddish brown. Magnetite = black.

H. of crystals 6. Turgite and black sulfids are softer.

Infusible.

Becomes magnetic in R.F.

Occ. In beds, veins, and with banded jaspers.

D. 334. M. & P. 217.

HEULANDITE. Hydrous calcium aluminium silicate, $H_4CaAl_2Si_6O_{18}.3H_2O$.

Coffin- or boat-shaped crystals with bright pearly cleavage surfaces. Monoclinic.

Side pinacoidal cleavage per. pearly. Stilbite similar but not as pearly, and its crystals are tabular and in sheaf-like groups.

H. 3.5–4.

Occ. With other zeolites in amygdules and fissures in basalt and diabase.

D. 454. M. & P. 414.

HEXAGONAL. All crystal forms referable to 3 like lateral directions (**axes**) meeting at 60°, and 1 unlike vertical direction (**axis**).

COMMON FORMS.

Base or basal pinacoid, 2 faces of like properties parallel to lateral axes: Molybdenite.

Prisms, 3, 6, or 12 faces, etc., parallel to vertical axis: Tourmaline.

Pyramids, 12 or 24 faces cutting 2 or 3 lateral and vertical axes: Corundum, Apatite.

Rhombohedrons, 6 four-sided faces cutting 2 lateral and vertical axes: Calcite.

Scalenohedrons, 12 scalene triangular faces cutting 3 lateral and vertical axes: Calcite.

HNO_3. Nitric acid.

HORNBLENDE. Magnesium calcium iron silicate, $Mg_3Ca_2FeSi_4O_{12}$.

Stout to prismatic monoclinic crystals, usually massive, columnar, fibrous, and granular.

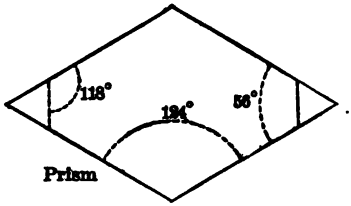

FIG. 10.—Cross-section of cleavage fragment showing the important forms and angles.

Prismatic cleavage perfect, with angle of 120°+. Augite usually lacks, but when present = 90°.

H. 5–6.

Greenish black to dark reddish brown.

Vitreous luster.

Fuses 3–4 with slight intumescence to dark shiny globule.

Occ. In granitic rocks and schists with quartz and feldspar.
D. 399. M. & P. 390.

HORNBLENDITE. Granular igneous rock composed essentially of hornblende, pyroxene, and olivine, with little or no feldspar.

HORN SILVER. See Cerargyrite.

HORSE-FLESH ORE. See Bornite.

H_2SO_4. Sulfuric acid.

HÜBNERITE, $MnWO_4$. See Wolframite.

HUMITE. A magnesium fluo-silicate, $Mg_5(Mg(F,OH))_2(SiO_4)_2$.
Orthorhombic crystals associated with and resembling Chondrodite, q.v.

HYACINTH. See Zircon.

HYALITE. Colorless transparent masses of Opal (q.v.), resembling drops of melted glass or gum-arabic.

HYPERSTHENE. Magnesium iron silicate, $(Mg,Fe)SiO_3$.
Massive, foliated, rarely in orthorhombic crystals.
Dark green, pinchbeck-brown to black, with bronzy iridescent luster or "Schiller." Side pinacoidal cleavage very prominent.
Fuses at 5 gently, easier with increase in Fe.
Occ. In gabbros, norites, etc., with labradorite, serpentine, etc.
D. 385. M. & P. 384.

ICELAND SPAR. See Calcite.

IDOCRASE. See Vesuvianite.

IGNEOUS ROCKS. All massive rocks forming from a molten mass (magma). See Basalt, Diabase, Diorite, Gabbro, Granite, Hornblendite, Peridotite, Pyroxenite, Syenite.

ILMENITE. **Titanium iron oxid, $FeTiO_3$.**
Massive, compact, granular, and rarely in rhombohedral crystals.
Stk. Black to brownish red. Hematite = cherry-red to reddish brown.
Feebly magnetic occasionally. Magnetite is always strongly so.
Titanium reactions.
Occ. In diabase and the more basic rocks, and the heavy black sand derived therefrom.
D. 336. M. & P. 219.

IMITATIVE. Resembling some natural object. See Amygdaloidal, Botryoidal, Dendritic, Nodular, Oölitic, Pisolitic, Reniform, Sheaf-like, and Stalactitic.

INFUSORIAL EARTH. Rock composed essentially of the shells, consisting of opaline silica, of the minute organisms called infusoria.

INTUMESCENCE. A swelling or expanding characteristic of certain minerals on being heated before the blowpipe or in the Bunsen flame, e.g., borax.

IOLITE. **Magnesium aluminium silicate, $Mg_2(AlFe)_4(SiO_4)_4(SiO_3)_4$.**
Massive, quartz-like embedded grains or short 6- or 12-sided prisms.
Resembles blue quartz.
Deep blue in one direction and at right angles is gray or yellow.
Fsy. 6, becoming opaque. Quartz is infusible.
Occ. In gneiss, schist, granite, and rarely volcanic rocks, with sillimanite and andalusite.
D. 407. M. & P. 394.

IRIDESCENT. Showing a play of rainbow colors, due either to a thin film of alteration product, usually an oxid, coating the surface of a mineral, or thin films of air included between cleavage lamellæ.

IRIDOSMINE. **Iridium with osmium and some rhodium, platinum, ruthenium, etc.**
Irregular flattened grains and hexagonal plates.
Metallic.
Tin-white to steel-gray.
H. 6–7. Rather brittle. · Platinum = 4–4.5 and is very malleable.
Sp.Gr. 19.3–21.1.
Infusible. Insoluble in acids.
Occ. With platinum, in black sand, etc.
D. 280. M. & P. 308.

IRON. **Native element, Fe.**
Massive and embedded particles.
Steel-gray to black.
H. 4–5. Malleable.
Hackly fracture.
Sp.Gr. 7.3–7.8.
Occ. In meteorites with pitted and fused surfaces as matrix or disseminated grains.
D. 281. M. & P. 208.

IRON PYRITES. See Pyrite.

ISINGLASS. See Muscovite.

Iso.w. Isomorphous (q.v.) with.

ISOMETRIC. All crystal forms referable to 3 rectilinear directions (**axes**) of like properties.

COMMON FORMS.

Cube, 6 faces of like physical properties, meeting at right angles: Fluorite.
Octahedron, 8 faces, etc., meeting at 109°+: Spinel.
Dodecahedron, 12 diamond-shaped faces, etc., meeting at 120°: Garnet.
Trapezohedron, 12 trapezohedral faces: Garnet.
Pyritohedron, 12 pentagonal faces: Pyrite.
Tetrahedron, 4 triangular faces: Tetrahedrite.

ISOMORPHOUS, Iso. Mineral substances are said to be iso. which form to a greater or less degree crystals consisting of a homogeneous mixture of the two or more substances.

JADE. A tough microscopically fibrous Tremolite or Actinolite, q.v.
H. 6.5. Jadeite = 7.
Splintery fracture.
Occ. In boulders.
D. 394. M. & P. 390.

JADEITE. **Sodium aluminium silicate, $NaAl(SiO_3)_2$.**
Compact, very tough, interlocking fibrous masses of pyroxene.
Grayish to dark green.
H. 7. Jade = 6.5.
Splintery fracture.
Fuses 2.5. Jade = 2.5+.
Occ. In boulders.
D. 393. M. & P. 386.

JAMESONITE. **Lead sulfantimonate, $Pb_2Sb_2S_5$.**
Acicular, fibrous, capillary, radiated.
Dark lead-gray to black, resembling tarnished silver.
H. 2–3. Brittle.
Basal cleavage prominent. Stibnite lacks this.
Sp.Gr. 5.5–6. Stibnite = 4.5.
Decrepitates, fuses at 1, and volatilizes.
Occ. With ores of antimony.
D. 308. M. & P. 259.

JASPER. A chalcedony (q.v.) impure from clay and iron.
Opaque, dull creamy luster.
Red, yellow, dark green, and grayish blue.

KAINITE. **Hydrous potassium magnesium chlorsulfate, $MgSO_4.KCl + 3H_2O$.**
Crusts and tabular to prismatic monoclinic crystals.

Colorless, white, dark red.
Biting salty taste.
Occ. With halite, etc.
D. 530. M. & P. 310.

KALINITE. **Hydrous potassium alum, $KAl(SO_4)_2.12H_2O$.**
Massive, fibrous, mealy crusts and artificial (alum) octahedral crystals.
H. 2.5. Brittle.
Alum taste.
Fuses at 1, froths to spongy mass, violet (K) flame.
Occ. With clay, kaolinized minerals, and clay-slate.
D. 535. M. & P. 311.

KAOLIN. See Kaolinite.

KAOLINITE. **Hydrous aluminium silicate, $H_4Al_2Si_2O_9$.**
Massive, compact, and clay-like.
Earthy odor when breathed on.
H. 1.5–2.5. Bauxite = 3.
Smooth feel. Infusorial earth feels harsh.
Plastic when mixed with water.
Yellow, brown, white (pure).
Infusible.
Occ. Alteration product of feldspar, etc., with feldspar and quartz, and in sedimentary beds.
D. 481. M. & P. 422.

KAOLINIZATION. The process of alteration of aluminous minerals, especially the feldspars, to kaolin.

LABRADORITE. **Calcium sodium aluminium silicate, $CaAl_2Si_2O_8 + NaAlSi_3O_8$.**
Massive, cleavable.
Tough. H. 5–6. Corundum = 9 and has two sets of striations.
Dark gray, grayish white.
May show a sheen of blue, green, and gold.
2 cleavages at about 90°, fine striations on the basal.

Sp.Gr. 2.73.

Occ. With enstatite as a constituent of basic igneous rocks.

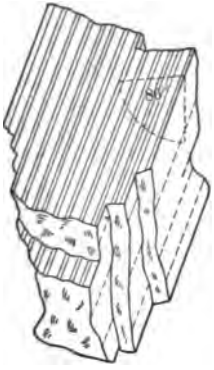

FIG. 11.—Fragment of Labradorite showing cleavages and striations.

D. 379. M. & P. 383.

LAMELLAR. Indistinct crystals grouped as layers or plates.

LAPIS-LAZULI. See Lazurite.

LAUMONTITE. Hydrous calcium aluminium silicate, $H_4CaAl_2Si_4O_{14}.2H_2O$.

Columnar, radiating, and divergent, and prisms with inclined terminations.

White to yellow, gray, red.

H. 3.5–4.

Transparent to translucent, becomes opaque and powdery on exposure.

Swells, fuses 2.5 to white enamel.

Gelatinizes in dilute HCl.

Occ. With other zeolites in amygdaloid and with calcite in veins in clay-slate.

D. 457.

LAVA. A general name for molten rock poured out by volcanic action.

LAZULITE. Aluminium fosfate, $2AlPO_4(Fe,Mg)(OH)_2$.

Acute pyramidal monoclinic crystals (nearly orthorhombic), massive, granular, and compact.

Smalt blue, azure blue.

H. 5–5.5. Malachite = 3.5–4; Turquois = 6.

Infusible, swells, loses color, and falls to pieces, which react for Al. Lazurite = 3.5.

Occ. In quartzite with cyanite and rutile.

D. 506.

LAZURITE. Sodium aluminium sulfosilicate, $Na_4(NaS_2Al)Al_2(SiO_4)_3$.

Massive, disseminated.

Azure, ultramarine, Berlin blue.

H. 5–5.5.

Fuses at 3.5.

Decomposed in HCl, yielding gelatinous silica and hydrogen sulfid.

Occ. Often with calcite and pyrite (lapis-lazuli).

D. 413. M. & P. 396.

LENTICULAR. Shaped in cross-section like a convex lens.

LEPIDOLITE. Lithium mica, $LiK(Al(OH,F)_2)Al(SiO_3)_3$.

Massive, scaly, granular, transparent crystals with perfect easy cleavage.

Micaceous.

Pale pink, white, gray.

Fuses 2–2.5 with intumescence to a white glass, sometimes magnetic. Margarite and muscovite = 4–4.5.

H. 2.5–4. Margarite = 3.5–4.5.

Occ. In pegmatite veins with lithia, tourmaline, amblygonite, spodumene, etc. Never with corundum.

D. 467. M. & P. 317.

LEUCITE. Potassium aluminium silicate, $KAl(SiO_3)_2$.

White to dirty-yellow trapezohedrons.

H. 5.5–6. Garnet is harder = 6.5–7.5. Analcite is softer = 5–5.5, and yields water in Cl.Tb.

Infusible. Analcite = 2.5.

Occ. In lavas with nephelite, sodalite, etc.

D. 381. M. & P. 384.

LIMESTONE. A sedimentary or metamorphic rock consisting of calcite.

LIMONITE. **Ferric hydroxid,** $Fe_2(OH)_6Fe_2O_3$.

Massive, compact, stalactitic, earthy, never crystallized, but may be in pseudomorphs after pyrite, etc.

H. 5–5.5. Hematite = 6.

Yellow streak. Hematite = cherry-red to brownish red.

Yields water in Cl.Tb. Hematite does not.

Does not decrepitate B.B. Turgite does, and has red streak. Goethite shows crystallization.

Occ. In bogs and as alteration product of all iron ores.

D. 350. M. & P. 221.

LINARITE. **Lead copper sulfate,** $CuPbSO_4.H_2O$.

Columnar, fibrous, long monoclinic crystals.

Smalt to pale blue.

Adamantine to vitreous.

H. 2.5. **Brittle.**

Front pinacoidal Cv. usually perfect. Azurite lacks cleavage faces.

Sp.Gr. 5.4. Azurite = 3.8.

Occ. With galenite.

D. 530. M. & P. 260.

LINNEITE. **Cobalt sulfid,** Co_3S_4.

Massive, compact, granular, and in octahedron alone and combined with cube.

Steel-gray, tarnishing copper-red.
H. 5.5.
Fuses at 2 to magnetic globule.
Soluble in dilute HNO_3 to red solution, with separation of sulfur.
Occ. With Co and Ni minerals, pyrrhotite, bornite, and chalcopyrite.
D. 297. M. & P. 294.

LITHIA MICA. See Lepidolite.

LODESTONE. See Magnetite.

MAGNESIUM MICA. See Biotite.

MAGNESITE. **Magnesium carbonate, $MgCO_3$.**
Massive, granular, cleavable to compact earthy, with appearance of unglazed porcelain. Rarely in rhombohedral crystals.
Tough when massive.
Flat conchoidal fracture.
H. 3.5–4.5.
White, yellow, gray, brown.
Effervesces in warm dilute HCl, in powder only. Dolomite and calcite do in mass.
Occ. With serpentine, talc, brucite, dolomite, etc.
D. 358. M. & P. 340.

MAGNETIC. A mineral or a bead is magnetic, that is, attracted by a magnet.

MAGNETIC IRON ORE. See Magnetite.

MAGNETIC PYRITES. See Pyrrhotite.

MAGNETITE. **Ferrous-ferric oxid, Fe_3O_4.**
Massive, with laminated structure, granular, coarse to fine. Octahedral crystals.
Will always jump to a magnet and is sometimes a magnet itself (lodestone).
Black streak. Hematite = red; Franklinite = dark brown; Chromite = light brown; Spinel = colorless.
Sp.Gr. 5.17.

H. 5. Tetrahedrite = 3.5.

Occ. Beds in metamorphic rocks and as accessory constituent of igneous rocks.

D. 339. M. & P. 215.

MALACHITE. Basic copper carbonate, $CuCO_3.Cu(OH)_2$.

Massive, imitative, encrusting, stalactitic, fibrous banded, granular, earthy, and rarely in monoclinic crystals.

Bright green, grass-green to nearly black.

Effervesces in acids.

Reacts for copper.

Occ. With all copper ores and in pseudomorphs after cuprite and azurite.

D. 364. M. & P. 290.

MALACOLITE. See Diopside.

MALLEABLE. A malleable substance is one from which slices may be cut off with a knife and then flattened with a hammer.

MAMMILLARY. Low convex (breast-shaped) mineral aggregates with radial fibrous structure and often concentric banding.

MANGANITE. Manganic hydroxid, MnO(OH).

Orthorhombic prisms, crystalline, columnar, and stalactitic.

Prisms deeply striated vertically.

Side pinacoidal and prismatic Cvs. perfect.

Steel-gray.

Reddish to black streak.

H. 4. Psilomelane = 5.5; Pyrolusite = 1–2.5.

Occ. With other oxids of manganese and hematite.

D. 349. M. & P. 230.

MANYCOLOR. The term "manycolor" is used to indicate minerals showing a range of color so variable as to be of no great determinative value.

MARCASITE. Iron disulfid, FeS_2.
Orthorhombic crystals and imitative forms (cockscombs, spear-heads, etc.); also in crystalline masses.
Pale bronze-yellow, somewhat lighter than pyrite on fresh surface.
Very subject to alteration.
Impossible to distinguish from pyrite except by crystals. Pyrite is isometric.
Occ. In sedimentary rocks, in concretions and nodules, and in veins with galenite and sphalerite.
D. 302. M. & P. 212.

MARGARITE. A calcium aluminium silicate, $H_2CaAl_4Si_2O_{12}$.
Massive, laminated, scaly, rarely in crystals.
Basal perfect Cv. pearly.
H. 3.5–4.5. Brittle. Lepidolite = 2.5–4 and is elastic.
Gray, pink, yellow.
Fuses 4–4.5. Lepidolite = 2–2.5.
Occ. With corundum as an alteration product, never in pegmatites.
D. 470.

MARL. A calcareous clay.

MASSIVE. A mineral showing no crystal faces. It may be either crystalline or amorphous, q.v.

MEERSCHAUM. See Sepiolite.

MELACONITE. See Tenorite.

MELANITE. A calcium, iron, titanium Garnet, q.v.
Velvet-black to brownish black.

MENACCANITE. See Ilmenite.

METAMORPHISM. A collective term for the processes by which rocks undergo chemical, physical, or mineralogical alteration.
Sedimentary rocks so changed are called meta-sedimentary and igneous meta-igneous.

MICA. Complex silicates of aluminium (sometimes partially replaced by iron, chromium, etc.), and an alkali, as potassium, sodium, or lithium.

Monoclinic crystals, with prism angles of about 120°, hence pseudo-hexagonal, pseudo-rhombohedral, or pseudo-orthorhombic.

Very perfect basal cleavage yielding thin elastic laminæ. See varieties: Biotite, Lepidolite, Muscovite, Phlogopite.

MICROCLINE. Potassium aluminium silicate, $KAlSi_3O_8$.

Same as orthoclase, except for grating structure on base (lines parallel to side and front pinacoid, therefore at right angles).

Sometimes greenish blue.

2 cleavages at 90°.

Occ. Same as orthoclase.

D. 373. M. & P. 380.

MILLERITE. Nickel sulfid, NiS.

Slender hair-like crystals, compact crusts of radiating fibres and rarely in larger wiry crystals.

Brass or bronze-yellow.

Elastic in slender crystals but brittle in masses.

H. 3–3.5.

Fuses 1.5–2, to magnetic globule which reacts for Ni in borax bead.

Occ. With calcite, dolomite, fluorite, in cavities in limestone; and in hematite or coating pyrrhotite.

D. 295. M. & P. 238.

MIMETITE. Lead chlor-arsenate, $Pb_5Cl(AsO_4)_3$.

Rounded keg-like aggregates of plates and small hexagonal crystals.

Resinous luster.

Brownish yellow.

H. 3.5. Brittle.

Sp.Gr. 7–7.2.

Fuses 1.5 to globule that does not show crystal-like faces on cooling. That of Pyromorphite does.

Soluble in HNO_3.

Occ. With pyromorphite, galena, etc., in upper levels of lead mines.

D. 500. M. & P. 262.

MOLYBDENITE. Molybdenum sulfid, MoS_2.

Graphite-like scales, foliated and granular.

Lead-gray with bluish tinge. Graphite = dark gray.

Bluish-gray stk. on paper.

Basal perfect cleavage.

Infusible.

On charcoal in O.F. = SO_2, near assay copper-red coat, distant white coat on continued heating which turns blue on being touched with R.F.

Occ. In granite, etc., schist, granular limestone, with pyrrhotite, yellow and white oxids of Mo, etc.

D. 285. M. & P. 278.

MONAZITE. A fosfate of rare earths, $(Ce.La.Di)PO_4 + ThSiO_4$.

Massive, granular, and small flat monoclinic crystals.

Brown crystals or yellow sand.

Translucent, resinous.

H. 5–5.5.

Sp.Gr. 5.

Infusible, turns gray.

Soluble with difficulty in HCl with white residue.

Reacts for P. (pale blue tinge to flame after dipping in H_2SO_4).

Occ. In black sands and as accessory constituent in granite, gneiss, etc.

D. 495. M. & P. 253.

Monoclinic. All crystal forms referable to 3 unlike directions (axes), (1) vertical, (2) inclined at various angles toward the front, (3) horizontal and at right angles to the plane of (1) and (2).

COMMON FORMS.

Pinacoids, 2 faces. **Basal,** sloping down toward observer, parallel to (2) and (3). **Front,** parallel to (1) and (3). **Side,** parallel to (1) and (2), at right angles to Basal: Orthoclase.

Prisms, 4 faces parallel to (1) and cutting (2) and (3): Amphibole.

Domes, Front and Back, 2 pairs of 2 faces parallel (3): Pyroxene. **Side,** 4 faces parallel to (2): Gypsum.

Hemipyramids, 4 faces cutting all 3 axes.

M. & P. Page references to Moses and Parson's text-book, "Mineralogy, Crystallography, and Blowpipe Analysis," 1904 edition, published by D. Van Nostrand Co., New York City.

MUNDIC. See Pyrite.

MUSCOVITE. Potassium mica, $H_2KAl_3(SiO_4)_3$.

Micaceous (disseminated scales), flakes, large sheets, globular masses, and rough crystals.

Basal cleavage eminent.

Manycolor, usually colorless to gray and green when Cr. is present. (Colorless in thin sheets.)

H. 2–2.5.

Highly elastic.

Occ. A constituent of **granite,** pegmatite, and mica schist.

D. 464. M. & P. 417.

NATIVE ULTRAMARINE. See Lazurite.

NATROLITE. Hydrous sodium aluminium silicate, $Na_2Al_2Si_3O_{10}.2H_2O$.

Slender radiating needle-like prisms with square cross-section, interlacing, rarely bladed, massive, granular, and compact.

H. 4.5–5.

Fuses 2 to a clear transparent glass. Aragonite = infusible. Pectolite = 2.5–3 to white glass.

Gelatinizes in dilute HCl.

Prismatic Cv. prominent in coarse varieties.

Occ. With other zeolites, prehnite, calcite, and datolite in cavities in basalt, etc.

D. 461. M. & P. 416.

NATURAL VERMILION. See Cinnabar.

NEEDLE ZEOLITE. See Natrolite.

NEPHELINE. See Nephelite.

NEPHELITE. Sodium aluminium silicate, approximately $NaAlSiO_4$.

Massive, gray, brownish or greenish (Elaeolite), and small glassy white hexagonal crystals (Nephelite).

Greasy luster.

H. 5.5–6. Quartz = 7. Apatite = 5.

Gelatinizes with dilute HCl. Scapolite and feldspar do not.

Cleavage not prominent.

Fuses at 4 quietly to colorless glass.

Occ. In alkaline igneous rocks with leucite, sodalite, sanadine, biotite, augite, etc.

D. 409. M. & P. 395.

NH_4OH. Ammonium hydroxid (ammonia).

NICCOLITE. Nickel arsenid, NiAs.

Massive, fine smooth texture, rarely in indistinct crystals.

Metallic.

Pale copper-red (bronzy) with dark tarnish.

H. 5–5.5. **Brittle.** Bornite = 3 and reacts for Cu. Copper = 2.5–3 and is malleable.

Black streak.

Occ. Intermixed with chloanthite, smaltite, etc., commonly coated with annabergite.

D. 295. M. & P. 239.

NICKEL BLOOM. See Annabergite.

NIGRINE. Black ferriferous Rutile, q.v.

NITER. **Potassium nitrate, KNO_3.**

Crusts, needle-like orthorhombic crystals and silky tufts. Unaltered on exposure.

Colorless, white, gray.

Cooling and salty taste.

On charcoal fuses 1, deflagrates violently like gunpowder.

Occ. In limestone caves, or as incrustation on surface or walls of rocks, and as constituent of soils.

D. 517. M. & P. 311.

NODULAR. A massive mineral in irregular rounded lumps.

NORITE. A rock of the gabbro family composed essentially of plagioclase and orthorhombic pyroxene, usually hypersthene.

NOUMEITE. See Garnierite.

OCCURRENCE, Occ. Occurrence, as here used, is limited to mode of occurrence and common associate minerals. These may be either original associates or alteration products.

OCTAHEDRITE. **Titanium dioxid, TiO_2.**

Acute or obtuse tetragonal pyramids, generally minute.

Brown, yellow, blue, etc.

Adamantine luster.
H. 5.5–6. Brittle. Spinel = 8.
Occ. With quartz, feldspar, **axinite,** ilmenite, chlorite, brookite, rutile, etc.
D. 346. M. & P. 252.

OCTAHEDRON. See **Isometric,** Chromite, Cuprite, Franklinite, Magnetite, Martite, Pyrite, and Spinel.

OLIGOCLASE. Soda-lime feldspar, 3 Albite, 1 Anorthite.
Massive and in triclinic crystals.
H. 6.
Colorless to white.
2 cleavages at about 90°.
Fine parallel striations.
Sp.Gr. 2.66.
Occ. Constituent of igneous rocks.
D. 378. M. & P. 383.

OLIVINE. See Chrysolite.

OLIVENITE. Hydrous copper arsenate, $Cu(Cu.OH)AsO_4$.
Orthorhombic prisms often acicular, fibrous (wood-copper), curved lamellar, and granular earthy.
Various shades of green, brown to white, especially olive-green.
H. 1. Earthy, 3 crystals.
Fuses at 2, coloring flame bluish green.
Soluble in HNO_3.
Occ. Coating quartz, etc., with other copper minerals.
D. 504. M. & P. 290.

ONYX. Parallel layers of Chalcedony, q.v. with contrasting colors.

OOLITIC. Like fish-roe. An aggregate of minute rounded mineral masses.

OPAL. Hydrous silica, $SiO_2 + nH_2O$.
Amorphous.
H. 6 can be scratched with a good knife. Quartz and chalcedony = 7.
Yields water in Cl.Tb. Quartz does not.

Precious opal, shows play of delicate colors.

Wood opal, shows woody structure.

Hyalite, glass-like or gum-arabiclike drops and layers.

Occ. In fissures in igneous rocks or imbedded in limestone.

D. 329. M. & P. 376.

OPEN TUBE. A straight piece of hard glass tube about 4 inches long by ⅛ inch in diameter, adapted for heating mineral fragments in a current of air and promoting the production of oxids which may possess odor, color, or other characters valuable as indicators of the elements present.

ORANGITE. See Thorite.

ORPIMENT. **Arsenic trisulfid, As_2S_3.**

Massive, disseminated, and in foliated plates.

Lemon-yellow.

Pale lemon-yellow stk.

Side pinacoidal cleavage perfect and prominent.

H. 1.5.

Sectile and flexible.

Occ. Usually with realgar in clay or limestone.

D. 282. M. & P. 271.

ORTHOCLASE. **Potassium aluminium silicate, $KAlSi_3O_8$.**

Massive, cleavable, and monoclinic crystals showing base, prism, and side pinacoid. **Carlsbad twins,** composition plane, the side pinacoid, twin axis, the vertical, basal Cvs. reversed in direction.

White, gray, red, flesh color, yellow, etc., transparent glassy fresh in lavas (Var. Sanadine).

H. 6–6.5.

2 Cvs. at 90°, no striations.

Fuses at 5 to porcelain bead. Other feldspars fuse more easily.

Occ. In granite, syenite, gneiss, **with mica**, hornblende, and *usually quartz*.

D. 370. M. & P. 378.

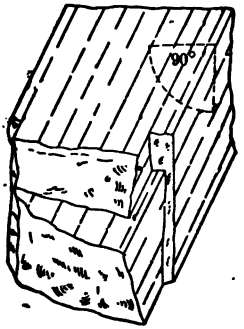

FIG. 12.—Fragment of Orthoclase showing the cleavage surfaces and rifts.

ORTHORHOMBIC. All crystal forms referable to 3 **unlike** rectilinear directions (**axes, 2 lateral and 1 vertical**).

COMMON FORMS.

Base or Basal pinacoid, 2 faces of like properties, parallel to lateral axes: Barite.

Front and Side pinacoids, 2 faces, etc., parallel to 1 lateral and the vertical axis: Stibnite, Topaz.

Prisms, 4 faces parallel to vertical axis: Topaz.

Domes, 4 faces parallel to 1 of the lateral axes: Barite.

Pyramids, 8 faces cutting all 3 axes: Sulfur.

OXIDIZING FLAME, O.F. That portion of the clear B.P. flame well out beyond the blue cone in which if substances are heated they tend to take on oxygen or oxidize.

PANDERMITE. See Colemanite.

PARTING. Easy separation along a plane not a cleavage plane but due to pressure twinning; e.g., basal parting of Augite and the rhombohedral parting of Corundum.

PEACOCK COPPER. See Chalcopyrite.

PEARCITE, $9Ag_2S.As_2S_3$. See Polybasite.

PEARL MICA. See Margarite.

PEARL SPAR. See Dolomite.

PEGMATITE. A coarse-grained igneous rock, ordinarily composed of quartz and feldspar masses (giant granite) occurring in pockets or veins. Diorite and gabbro are occasionally found with coarse enough grain to be called pegmatites.

PENCIL STONE. See Pyrophyllite.

PENNINITE, $H_8(Mg,Fe)_5Al_2Si_3O_{16}$. See Chlorite.

PENTLANDITE. Iron nickel sulfid (Fe,Ni)S.

Granular masses.

Parting parallel to octahedron.

Light bronze-yellow.

Not magnetic. Pyrrhotite is slightly magnetic.

H. 3.5–4. Brittle.

Fuses 1.5–2 to magnetic globule.

Occ. Intergrown intimately with pyrrhotite and chalcopyrite.

D. 293. M. & P. 238.

PERFECT, Per. A smooth cleavage surface such that, held close to the eye, it gives a good reflection of distant objects.

PERIDOT. See Chrysolite.

PERIDOTITE. Granular **igneous** rocks composed essentially of olivine and pyroxene, with little or no feldspar.

PHENACITE. Beryllium silicate, Be_2SiO_4. Rhombohedral crystals usually without prism planes.

Colorless, wine-yellow, rose-red, brown.

Prismatic cleavage distinct. Beryl lacks this.

H. 7.5–8. Quartz = 7.

Infusible.

Occ. With beryl, chrysoberyl, and microcline.

D. 423. M. & P. 399.

PHENOCRYST. A crystal of a rock-forming mineral which is conspicuously larger than those of the surrounding minerals.

PHILLIPSITE. Hydrous potassium calcium aluminium silicate, $(K_2,Ca)Al_2Si_4O_{12}.4H_2O$. Monoclinic penetration twins, pseudo-orthorhombic or pseudo-tetragonal. Nearly square prism terminated apparently with pyramid, a double set of striations.

Crumbles, fuses 3 without swelling to white enamel.

Gelatinizes in HCl.

Occ. Translucent crystals in cavities in basalt.

D. 455.

PHLOGOPITE. Magnesium mica, $H_2KMg_3Al(SiO_4)_3$?. Pseudo-hexagonal crystals, micaceous scales, flakes, and sheets.

Light brown to cinnamon-brown. Lighter-colored than biotite.

H. 2.5–3. Tough.

Basal perfect cleavage, yielding elastic plates.

Occ. In crystalline limestones with pale-green apatite and serpentine.

D. 469. M. & P. 419.

PHOSPHATE ROCK. See Apatite.

PIEDMONTITE. A red manganiferous Epidote, q.v.

PINACOID. A crystal form consisting of two faces parallel to two axes (three in hexagonal) and perpendicular to one. Three kinds are distinguished, basal, front, and side. See Tetragonal, Hexagonal, Orthorhombic, Monoclinic, and Triclinic.

PISOLITIC. An aggregate of pea-shaped masses, e.g., Bauxite.

PITCH-BLENDE. See Uraninite.

PLAGIOCLASE. A group name for the triclinic feldspars, distinguished from orthoclase by the fine parallel striations due to repeated twinning. See Albite, Anorthite, Labradorite, Oligoclase.
D. 374. M. & P. 381.

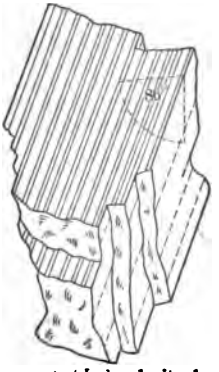

FIG. 13.—Fragment of Labradorite showing cleavages and striations.

PLATINUM. **Native element, Pt.**
Nuggets and grains.
Metallic. Tin-white to light steel-gray.
H. 4–4.5. Malleable.

Sp.Gr. 14–19. Very heavy.
Magnetic when ferriferous.
Insoluble in HCl. Infusible.
Occ. In gold-bearing sands and gravels, generally derived from peridotites.
D. 280. M. & P. 308.

PLATY. A massive mineral in separable layers, e.g., Albite.

PLUMBAGO. See Graphite.

POLYBASITE. Silver sulfantimonate, Ag_9SbS_6, with Cu iso.w. Ag.
Six-sided tabular monoclinic prisms with beveled edges. Base with tri-striations.
Iron-black, but in thin splinters cherry-red.
Occ. With chalcopyrite, calcite, and lead and silver minerals.
D. 314. M. & P. 301.

POTASH MICA. See Muscovite.

PRASE. Dull leek-green Chalcedony, q.v.

PREHNITE. Calcium aluminium silicate, $H_2Ca_2Al_2Si_3O_{13}$.
Sheaf-like and barrel-shaped groups of tabular crystals and imitative crusts.
Fsy. 2.5 with swelling and intumescence to a blebby enamel. Calamine = +5–7; Smithsonite = 7.
Gelatinizes in dilute HCl after fusion, but not before.
Occ. In granite, syenite, gneiss, basalt, and diabase in veins and cavities as a secondary mineral with datolite and the zeolites.
D. 442. M. & P. 408.

PRICEITE. See Colemanite.

PRIMARY. An original unaltered mineral.

PRISM. A crystal form of 2, 4, 6, 12, etc., faces parallel to the vertical axis and cutting one or more of the lateral axes. See Tetragonal, Hexagonal, Orthorhombic, Monoclinic, and Triclinic.

PRISMATIC. Crystals elongated parallel to one direction, generally regarded as the vertical, e.g. Stibnite, but in some cases, e.g. Epidote, as one of the lateral axes.

PROCHLORITE. See Chlorite.

PROUSTITE. Silver sulfarsenite, Ag_3AsS_3. Rhombohedral crystals, red bands, streaks, stains, and crusts.

Scarlet to vermilion. Adamantine luster.

Scarlet Stk. Pyrargyrite = purplish red; Realgar = orange.

Fuses on charcoal at 1, yielding garlic odor and residue of silver. Cuprite = metallic Cu. Cinnabar volatilizes.

Occ. "Light ruby-silver ore," often with gray pyrargyrite.

D. 311. M. & P. 299.

PSEUDOMORPH. A crystallized mineral which has suffered chemical change so that its form no longer belongs to its chemical composition, e.g., Limonite, in the form of Pyrite; Quartz, in the form of Fluorite.

PSILOMELANE. Manganese hydrate, composition doubtful, Ba usually present. Amorphous, massive, stalactitic, and imitative, never crystallized.

H. 5.5. Pyrolusite = 1–2.5; Manganite = 4.

Brownish-black to dark-gray streak. Limonite = yellow.

Occ. With pyrolusite and limonite.

D. 352. M. & P. 231.

PURPLE COPPER ORE. See Bornite.

PYRAMID. A crystal form cutting the vertical and one or more of the lateral axes. See Tetragonal, Hexagonal, Orthorhombic, Monoclinic, and Triclinic.

PYRARGYRITE. Silver sulfantimonate, Ag_3SbS_3.

Massive, disseminated streaks and thin fibers. Prismatic rhombohedral.

Steel-gray nearly black, purple-red by transmitted light.

Purplish-red streak. Proustite = scarlet; Cuprite = brownish red; Realgar = orange; Cinnabar = vermilion.

Occ. With proustite, arsenopyrite, tetrahedrite, galena, etc., in quartz veins.

D. 311. M. & P. 299.

PYRITE. Iron disulfid, FeS_2.

Usually in isometric crystals; also massive, fine granular, subfibrous, radiated, and globular.

Cube, pyritohedron, octahedron. Marcasite = orthorhombic crystals, usually twinned.

Pale brass-yellow. Chalcopyrite has deeper color.

H. 6–6.5. Brittle. Chalcopyrite = 3.5–4; Gold = 2 and is malleable.

Occ. With other sulfids, limonite, etc.

D. 300. M. & P. 210.

PYRITOHEDRON. See Isometric, Cobaltite, Limonite, Martite, Pyrite.

PYROLUSITE. Manganese dioxid, MnO_2+H_2O.

Massive, stalactitic, radiated, granular, earthy, and encrusting. Pseudomorphic.

H. 1–2.5, soils fingers.

Black to steel-gray streak.

Crystalline structure.

Occ. With psilomelane, hematite, limonite, and manganite.

D. 347. M. & P. 229.

PYROMORPHITE. Lead chlorofosfate, $Pb_4(Pb,Cl)(PO_4)_3$.

Short, deeply striated hexagonal prisms, often curved, in parallel position; and massive, interlaced, fibrous, globular, reniform, and granular.

White, especially green and yellow.

H. 3.5–4. Apatite = 5.

Sp. Gr. 6.5–7.1. Very heavy for mineral showing hexagonal prism.

Fuses at 2 to a globule which shows crystal-like faces on cooling. Other Pb minerals reduce to metal.

Occ. With other lead minerals, especially cerussite, anglesite, and mimetite.

D. 499. M. & P. 260.

PYROPE. A magnesium Garnet, q.v.

PYROPHYLLITE. Hydrous aluminium silicate, $H_2Al_2(SiO_3)_4$.

Small hemispheres of radiating fibers, foliated, granular, compact, and slaty.

H. 1–2, soft and greasy like talc.

Flexible, non-elastic.

White, gray, brown.

Reacts for Al. Talc does not.

Fuses 5–6, often swells and spreads like a fan.

Occ. In large beds in crystalline schists, and granular as matrix of cyanite.

D. 482. M. & P. 423.

PYROXENE. Metasilicate, chiefly of iron, calcium, magnesium, etc., $CaMg(SiO_3)_2$.

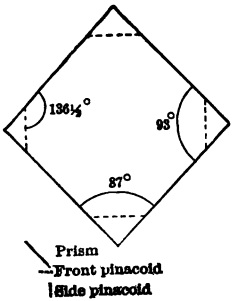

FIG. 14.—Cross-section of crystal showing important forms and angles.

Massive, granular, foliated, columnar, rarely fibrous. Monoclinic crystals.

Lack of cleavage, or the somewhat obscure prismatic with nearly 90° angle (see page 71).

Basal parting.

Fsy. 4–4.5, usually quietly.

Occ. Common constituent of the igneous rocks. See varieties: Augite, Diopside.

D. 382. M. & P. 385.

PYROXENE, Orthorhombic varieties. See Bronzite, Enstatite, Hypersthene.

PYROXENITE. Granular igneous rock, composed essentially of pyroxene and olivine, with little or no feldspar.

PYRRHOTITE. Iron sulfid, Fe_nS_{n+1}.

Massive, granular, laminated, and rare platy crystals.

Metallic luster.

Bronze-yellow, copper-red, tarnishing rapidly to pinchbeck- or bronze-brown. Chalcopyrite = brass-yellow.

Slightly magnetic.

H. 3.5–4.5. Other iron sulfids are harder.

Occ. In gabbros, schists, meteorites; and in veins with chalcopyrite.

D. 296. M. & P. 209.

QUARTZ. Silicon dioxid, SiO_2.

Hexagonal prism and pyramid (+ and − rhombohedron), and in crystalline masses.

H. 7. Cleavage absent.

Conchoidal fracture.

Usually white or colorless. Colored varieties due to various impurities.

Set up crystals by placing striations on prism horizontal.

Infusible.

Insoluble in acids.

Occ. Commonest of all minerals, in many igneous rocks, e.g. granite; sedimentary rocks, e.g. sandstone; metasedimentary rocks, e.g. quartzite; and as the principal filling of veins.

D. 324. M. & P. 372.

QUARTZITE. A metamorphosed sandstone.

Q.V. Quod vide = which see.

REALGAR. Arsenic disulfid, As_2S_2.

Massive, granular, and in monoclinic crystals.

Bright red to orange-red or yellow.

Orange-red streak.

H. 1.5–2. Sectile.

Side pinacoidal Cv. rather prominent.

Orpiment do. very prominent.

Occ. Chiefly in lead and silver veins, often with orpiment.

D. 282. M. & P. 271.

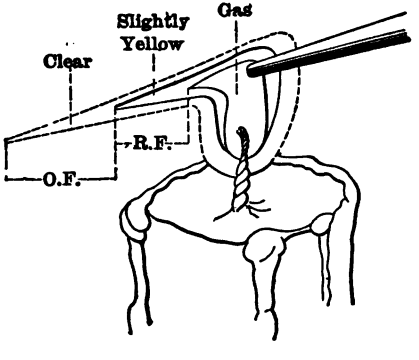

FIG. 15.—Blowpipe-flame as obtained from candle.

REDUCING FLAME, R.F. A slightly yellow blowpipe-flame, poor in oxygen, and tend-

ing to remove oxygen from oxids or to reduce them.

RED IRON ORE. See Hematite.

RED OXID OF COPPER. See Cuprite.

RED ZINC ORE. See Zincite.

RENIFORM. Kidney-shaped, e.g., Hematite.

RETICULATED. Mineral fibers crossed like the meshes of a net, e.g., Rutile, Stibnite, native Silver.

R.F. Reducing Flame, q.v.

RHODOCHROSITE. Manganous carbonate, $MnCO_3$.

Massive, cleavable, granular, compact, and imitative. Rarely in crystals.

Rhombohedral cleavage.

Light pink, rose-red, brownish red, and brown.

Effervesces in hot dilute HCl.

H. 4. Calcite = 3; Rhodonite = 5–5.5.

Occ. With manganese and silver minerals.

D. 359. M. & P. 231.

RHODONITE. Manganous silicate, $MnSiO_3$(Fe,Zn,Ca).

Massive, fine-grained or cleavable, and in triclinic crystals.

Prismatic and basal Cvs. at about 90°.

H. 5.5–6. Rhodochrosite = 4.

Fuses at 2.5, blackens, intumesces. Rhodochrosite is infusible and dissolves **completely** in warm dilute HCl.

Occ. With franklinite embedded in calcite, with silver ores and chalcopyrite.

D. 395. M. & P. 387.

RIPIDOLITE. See Chlorite.

ROCK CRYSTAL. Colorless Quartz, q.v.

ROCKS. Brief definitions of the rocks mentioned with the minerals will be found in their alphabetic position.

For further explanations, see "Handbook of Rocks," Kemp, and "Quantitative Classification of Igneous Rocks," Cross, Iddings, Pirsson, and Washington. The Field Definitions are those recommended by the latter work.

ROSE QUARTZ. Light-pink to rose-red Quartz, q.v.

RUBELLITE. Lithia Tourmaline, q.v.

RUBY. Gem var. of Corundum, q.v.

RUBY COPPER ORE. See Cuprite.

RUBY SILVER. See Proustite and Pyrargyrite.

RUBY ZINC. See Zincite.

RUTILE. Titanium dioxid, TiO_2.

Tetragonal, dark prisms, hair-like to coarse, with deep striations, knee-shaped twins; and massive black iron-bearing (nigrine).

Stk. White to pale brown.

Sp.Gr. 4.2. Cassiterite = about 7.

Infusible. Garnet, Tourmaline, Vesuvianite, and Pyroxene are less metallic in luster and more or less fusible.

Occ. Often in quartz.

D. 345. M. & P. 251.

SAL AMMONIAC. Ammonium chlorid, NH_4Cl.

Incrustation.

Colorless, white, yellowish.

Pungent salty taste.

B.B. Sublimes to white fumes without fusion.

In Cl.Tb. with ignited calcite yields odor of ammonia.

Occ. Near volcanoes, burning coal-beds, and guano deposits.

D. 319. M. & P. 318.

SANADINE. Glassy, white or colorless crystals of Orthoclase, q.v.

SANDSTONE. A rock consisting chiefly of quartz grains held together by either a siliceous, ferruginous, or calcareous cement.

SAPPHIRE. Gem var. of Corundum, q.v.

SARD. Deep-red Chalcedony, q.v.

SARDONYX. Layers of lighter-colored Chalcedony (q.v.) alternating with layers of Sard (q.v.).

SCAPOLITE. Aluminium calcium sodium silicate, $Ca_4Al_6Si_6O_{25}$ with $Na_4Al_3Si_9O_{24}$.

Coarse, thick, tetragonal crystals, massive, columnar, and granular.

Poor prismatic Cv., yielding surface with a fibrous texture. Feldspars lack this texture.

H. 5.5. Fluorite = 4.

Fuses at 3 with intumescence to white glass containing bubbles. Feldspars = 4–5. Pyroxene does not intumesce. Tremolite = 4 to glass free of bubbles.

Does not gelatinize in acids. Nephelite does.

Occ. Contact of igneous rocks and limestone.

D. 424. M. & P. 400.

SCHEELITE. Calcium tungstate, $CaWO_4$.

Square pyramids (nearly octahedrons), massive, granular, reniform, and columnar.

White, gray, and yellow.

Sp.Gr. 5.4–6.1. High for non-metallic mineral.

H. 4.5–5. Fluorite = 4; Topaz = 8; Quartz = 7.

Pyramidal Cv. fair. Fluorite = octahedral perfect.

Clear bead in S Ph, turns blue in R.F. with excess of mineral.

Occ. In veins with cassiterite, wolframite, fluorite, molybdenite, and quartz.
D. 540. M. & P. 339.

SCHIST. Meta-sedimentary or meta-igneous rock finely laminated and separating easily into plates with an uneven surface. Varieties are named from the prominent mineral constituent, as hornblende, chlorite, talc, epidote, glaucophane, etc.

SCHORL. See Tourmaline.

SCOLECITE. Hydrous calcium aluminium silicate, $CaAl_2Si_3O_{10}.3H_2O$.
Slender prismatic crystals, with feather-like striations diverging upwards on side pinacoid, in divergent groups; massive, fibrous, radiated, and nodular.
Prismatic Cv. nearly per.
H. 5–5.5.
B.B. May curl up like a worm, or may intumesce only slightly; fuses at 2–2.5 to white enamel.
Gelatinizes in HCl.
Occ. In amygdaloid with other zeolites.
D. 462.

SCORODITE. Hydrous ferric arsenate, $FeAsO_4.2H_2O$.
Orthorhombic crystals showing octahedral-like pyramid, prism, etc.; also earthy, amorphous.
Pale leek-green, liver-brown.
White streak.
H. 3.5–4. Brittle.
Cl.Tb. Yields water, turns yellow.
Fuses 2–2.5, coloring flame blue.
Soluble in HCl.
Occ. With arsenopyrite.
D. 509.

SECONDARY. A mineral derived from another mineral by alteration.

Sectile. A mineral or a bead from which a shaving cut off with a knife powders when struck with a hammer.

SELENITE. See Gypsum.

SENARMONTITE. **Antimony trioxid,** Sb_2O_3.

Pearl-gray, granular, massive, crusts and octahedrons.

Fuses 1.5, dense white inodorous fumes.

Occ. With stibnite and antimony.

D. 330. M. & P. 275.

SEPIOLITE. **Hydrous magnesium silicate,** $H_4Mg_2Si_3O_{10}$.

Compact, massive, mammillary, reniform, and clay-like. Meerschaum.

H. 2–2.5.

Soft, smooth feel. Lacks earthy odor of kaolin.

Occ. Nodules in clay and with serpentine, and in limestone.

D. 480. M. & P. 422.

SERPENTINE. **Hydrous magnesium silicate,** $H_4(Mg.Fe)_3Si_2O_9$.

Foliated, fibrous, asbestiform; massive, granular, coarse to fine.

Manycolor, often a shade of green.

H. 2.5–4. Talc = 1; Garnierite = 2–3 and is friable.

Feels smooth, almost greasy.

Fuses with difficulty.

Dissolves in HCl without gelatinization but with a residue of silica; solution reacts for Mg.

Cl.Tb. Yields water. Other asbestiform minerals do not.

Occ. Often as rock, as alteration product of pyroxenite, peridotite, etc., with chrysolite, amphibole, pyroxene, magnetite, chromite, garnierite, etc., and fibrous variety, **chrysotile,** as veins in massive.

D. 476. M. & P. 420.

SERPENTINIZATION. The process of alteration of magnesian minerals to serpentine, e.g., Chrysolite.

SHEAF-LIKE. Resembling a sheaf of wheat.

SIDE PINACOID. A crystal form parallel to the front to back and the vertical axes. See Orthorhombic, Monoclinic, and Triclinic.

SIDERITE. Ferrous carbonate, $FeCO_3$.

Massive, cleavable, granular, imitative, and earthy. Rarely in crystals.

Rhombohedral Cv. and form.

Vitreous or pearly luster. Sphalerite is resinous and has dodecahedral Cv.

Effervesces when powdered in warm dilute HCl.

Sp.Gr. 3.86. Most carbonates are lower.

H. 3.5–4. Apatite = 5.

Occ. With cryolite, sulfids, quartz, hematite, and fluorite. Most common variety "Ironstone," in clay-slate.

D. 359. M. & P. 226.

SILICEOUS SINTER. Loose porous opaline silica deposited from hot water.

SILLIMANITE. Aluminium silicate, Al_2SiO_5.

Long bent fibrous interwoven crystals, not distinctly terminated, and massive, fibrous, or columnar.

Hair-brown, gray, or green.

Square cross-section.

Side pinacoidal Cv. per. Andalusite lacks this.

H. 7.

Infusible.

Reacts for alumina.

Occ. Chiefly in mica schist with cyanite, andalusite, and corundum.

D. 433. M. & P. 405.

SILVER. Native element, Ag.

Massive, arborescent, filiform, wires, specks, scales, and sheets.

Silver-white, usually tarnished to gray or black.
H. 2.5. Malleable.
Hackly fracture.
Fuses at 2 to non-volatile globule white on fresh-cut surface.
Soluble in dilute warm HNO_3; addition of soluble chlorid precipitates AgCl, which darkens on exposure.
Occ. With other Ag minerals, pyrite, stibnite, galena, barite, calcite, etc.
D. 278. M. & P. 296.

SILVER GLANCE. See Argentite.

SLATE. Meta-shale or clay possessing a perfect easy plane of separation (cleavage), at any angle to the plane of stratification, along which the rock breaks into thin smooth plates.

SMALTITE—CHLOANTHITE. **Cobalt to nickel arsenid, $(Co,Ni)As_2$.**
Crystalline, massive, granular, imitative, and rarely isometric crystals.
Metallic.
Tin-white to steel-gray.
Fuses 2.5 with garlic odor to magnetic globule.
Soluble in dilute HNO_3 to red or green solution, according to percentage of Co or Ni present.
After roasting, reacts for Co or Ni. Arsenopyrite reacts for Fe.
Occ. With niccolite and erythrite.
D. 301. M. & P. 235.

SMARAGDITE. A green variety of Amphibole.
D. 401.

SMITHSONITE. **Zinc carbonate, $ZnCO_3$.**
Massive, imitative, with drusy surface. Rarely in small rhombohedrons. "Dry-bone."
Usually compact like chalcedony.

Greasy yellow "turkey fat," gray, and shades of blue-green.

Effervesces powdered in warm dilute HCl. Calamine does not.

H. 3.5–4. Other carbonates are softer.

Sp.Gr. 4.4. High for carbonate.

Zn reaction on charcoal with soda and charcoal powder.

Occ. With ores of zinc as alteration product of sphalerite, frequently intermixed with calamine.

D. 360. M. & P. 244.

SMOKY QUARTZ. Dark-yellow to black Quartz, q.v.

SOAPSTONE. See Talc.

SODA. Sodium carbonate, Na_2CO_3, dry.

SODA NITER or CHILI SALTPETER. Sodium nitrate, $NaNO_3$.

Granular masses or crusts, rarely in cube-like rhombohedral crystals. Crumbles to powder on exposure.

Colorless, white, or yellowish.

Cooling and salty taste.

Very soluble in water.

On charcoal fuses at 1, deflagrates less violently than potassium niter.

Occ. With halite, gypsum, and many soluble salts.

D. 517. M. & P. 314.

SODALITE. Sodium aluminium chlorsilicate, $Na_4(AlCl)Al_2(SiO_4)_3$.

Massive, cleavable, and granular.

Dodecahedral Cv. present with variable perfection.

Lavender-blue, azure blue.

H. 5.5–6.

Fuses 3.5–4 to a colorless glass.

Reacts for chlorine. Lazurite does not.

Occ. Usually with nephelite, leucite, and albite in syenite.

D. 412. M. & P. 395.

SPATHIC ORE. See Siderite.

SPECULAR IRON. See Hematite.

SPERRYLITE. Platinum arsenid, $PtAs_2$.

Minute isometric crystals.

Tin-white.

Black streak.

H. 6–7.

Sp.Gr. 10.6.

Fuses at 2.

In open tube yields a sponge insoluble in any single acid.

Occ. Very rare vein mineral with cassiterite, pyrrhotite, covellite, chalcopyrite, pyrite, etc.

D. 302. M. & P. 308.

SPESSARTITE. A manganese Garnet, q.v.

SP. GR. Specific gravity. The ratio of the weight of a substance to the weight of an equal volume of water.

S Ph. Hydrogen sodium ammonium fosfate, $HNaNH_4PO_4.4H_2O$; sometimes called **microcosmic salt.**

SPHALERITE. Zinc sulfid, ZnS.

Massive, cleavable, granular to compact, fibrous, radiated, and nodular. Rough **isometric crystals.**

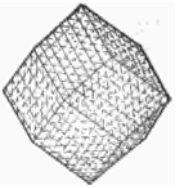

FIG. 16.—Cleavage dodecahedron cross-lined to show directions of cleavage rifts.

Dodecahedral cleavage per. Siderite = rhombohedral.

H. 3.5–4. Garnet = 7; Cassiterite = 6.5.

Resinous luster.

Yellow to white pure; brown, black, etc., owing to replacement of Zn by Fe.

Soluble in CHl with effervescence of H_2S.

Occ. With lead and silver minerals.

D. 291. M. & P. 242.

SPHENE. See Titanite.

SPHENOID. A tetragonal form having four faces. See Tetragonal and Chalcopyrite.

SPINEL. **Magnesium aluminate, $MgAl_2O_4$.**

Octahedral crystals, simple or twinned, varying in color.

Streak white.

H. 8. Cannot be scratched by steel or quartz.

Infusible.

Sp.Gr. 4. Zircon = 4.7.

Occ. In limestone, gneiss, serpentine, with corundum, chondrodite, brucite, and talc.

D. 338. M. & P. 341.

SPODUMENE. **Lithium aluminium silicate, $LiAl(SiO_3)_2$.**

Large white or gray monoclinic crystals, massive, parting on front dome into broad smooth plates.

Prismatic cleavage 93°.

Sp.Gr. 3.16+. Feldspar and Scapolite are lower.

H. 6.

Fsy. Whitens, branches, becomes opaque, fuses 3.5 to clear white glass. Colors flame carmine-red. Tremolite = Ca (yellow-red flame).

Occ. In granite pegmatite with garnet and tourmaline.

D. 393. M. & P. 316.

STALACTITES. Icicle-like mineral aggregates forming in caves, etc., e.g., Calcite.

STANNITE. Copper and iron sulfo-stannate, Cu_2FeSnS_4.

Massive, granular, rarely in tetragonal pseudo-isometric crystals.

Metallic luster.

Steel-gray.

Black streak.

H. 4. Brittle.

Fuses in R.F. at 1.5.

Soluble in HNO_3 to a green solution.

Occ. Often intermixed with chalcopyrite.

D. 315. M. & P. 249.

STAUROLITE. A ferrous aluminium silicate, $Fe(AlO)_4(Al,OH)(SiO_4)_2$.

Often very impure.

Flat prismatic orthorhombic crystals.

Cleavage lacking. Amphibole has about same prism angle and per. Cv.

Cross and X-shaped twins.

Infusible.

H. 7–7.5.

Occ. In schists with andalusite, cyanite, sillimanite, garnet, chlorite, and tourmaline.

D. 450. M. & P. 410.

STEATITE. See Talc.

STEPHANITE. Silver sulfantimonate, Ag_5SbS_4.

Massive, fine granular, disseminated; short, stout, or flat pseudo-hexagonal disks.

Iron-black; metallic.

H. 2–2.5. Very brittle. Argentite is sectile. Tetrahedrite = 3–4.5.

On charcoal fuses at 1, throws off small particles, white fumes and coat, and malleable silver. Argentite lacks white fumes and coat.

Occ. With silver minerals, argentite, barite, quartz, galena, etc.

D. 314. M. & P. 300.

STIBNITE. Antimony trisulfid, Sb_2S_3.
Vertically striated orthorhombic prisms, sometimes twisted, in radiating groups; also massive, compact.
Metallic luster.
Lead-gray, sometimes tarnishing iridescent.
Side pinacoidal cleavage highly perfect.
H. 2. Other metallic sulphids are harder, except Bismuthenite, which can be distinguished chemically.
Fuses at 1, volatilizes. Other sulfids except those of As are less fusible.
Inodorous fumes. As = garlic.
Sp.Gr. 4.5.
Occ. In quartz veins with other antimony minerals, especially white and yellow oxids.
D. 283. M. & P. 273.

STILBITE. Hydrous calcium aluminium silicate, $CaAl_2Si_6O_{16}.6H_2O$.
Tabular crystals in **sheaf-like** and radiating groups.
Pseudo-orthorhombic twins.
Side pinacoidal cleavage perfect, pearly.
Exfoliates, fuses 2–2.5 to white enamel.
Does not gelatinize in dilute HCl, but dissolves with residue of slimy silica.
Occ. With chabazite, apophyllite, heulandite, harmotome, etc., in amygdaloid and fissures in diabase.
D. 456. M. & P. 414.

STK. Streak, q.v.

STREAK, Stk. The streak of a mineral is the color of its powder, which is generally obtained by rubbing the mineral on unglazed porcelain (streak plate).
Streak is more characteristic of a nonmetallic mineral than its color.

STREAM-TIN. See Cassiterite.

STRIATIONS. Sharply cut parallel lines or furrows, due to repeated twinning or oscillatory growth; e.g., cleavage surface of labradorite and cubes of pyrite.

STRONTIANITE. Strontium carbonate, $SrCO_3$.

Massive, radiated, fibrous, and granular. Needle- and spear-shaped crystal.

Fsy. 6, swells, sprouts, and colors flame crimson. Calcite and aragonite do not swell or sprout and color flame yellow-red. Witherite = 2.5–3 and colors flame yellow-green.

Effervesces in cold dilute HCl.

Sp.Gr. 3.7. Aragonite = 2.9.

Occ. In veins in limestone, forming nests and lining geodes; also in gneiss.

D. 362. M. & P. 323.

SUBLIMATE. Any solid or liquid product formed on heating a mineral fragment or powder in a closed or open tube, or on charcoal or other support. A sublimate may be either volatile or non-volatile.

SULFUR. Native element, S.

Pyramidal orthorhombic crystals; massive, granular, powder, crusts, stalactites, etc.

Sulfur-yellow, honey-yellow, brown, and gray.

Resinous, greasy, vitreous.

Conchoidal fracture.

H. 1.5–2.5. Brittle.

Burns easily with blue flame and pungent odor.

Occ. With celestite, aragonite, cinnabar, gypsum, and limestone.

D. 273. M. & P. 360.

SYENITE. Igneous rock composed predominantly of orthoclase, with minor amounts of other feldspar, biotite, amphibole, and pyroxene, but poor in quartz.

Field Definition. All granular igneous rock composed of dominant feldspars of any kind, with subordinate amounts of mica, hornblende, pyroxene, or other minerals, and without a noticeable amount of quartz.

SYLVANITE. **Gold-silver tellurid, $(Au,Ag)Te_2$.**
Steel-gray to pale-yellow platy groups of crystals.
Side pinacoidal cleavage perfect. Calaverite lacks this.
Brittle. Gold is sectile.
H. 1.5. Yellow sulfids are harder.
Occ. Often in gray phonolite with purple fluorite; also in schist.
D. 304. M. & P. 306.

SYLVITE. **Potassium chlorid, KCl.**
Massive, granular, compact, and in cubo-octahedral crystals.
White, bluish, yellowish red.
Salty taste.
Cubic cleavage.
Soluble in water.
Absorbs water and becomes damp.
Occ. With halite, etc.
D. 318. M. & P. 310.

SYMMETRY. The repetition of like parts in a regular order or sequence.

TABULAR. A crystal flattened parallel to any pair of faces; these are chosen as the base when possible.

TALC. **Hydrous magnesian silicate, $H_2Mg_3(SiO_3)_4$.**
Massive, foliated, fibrous (pseudomorphic), and compact.
Soft and soapy. Chlorite is not soapy.
H. 1. Micas and serpentine are harder.
Basal per. Cv. to flexible non-elastic plates. Micas = elastic plates.

Fuses with extreme difficulty 6.5. Chlorite = 4–5.

Insoluble in HCl.

Occ. As talc schist with chlorite, serpentine, dolomite, magnetite, actinolite, quartz, etc., in part as alteration product of amphibole, pyroxene, etc.

D. 479. M. & P. 421.

TANTALITE. See Columbite.

D. 490. M. & P. 225.

TENNANTITE. **Copper sulfarsenite, $Cu_4As_2S_7$.**

Dodecahedral crystals, etc., massive and compact.

See Tetrahedrite. Sb replaced by As.

D. 313. M. & P. 288.

TENORITE. **Cupric oxid, CuO.**

Thin, shiny, flexible scales and massive earthy.

Steel-gray to black.

H. 3–4.

Fuses at 2.

Occ. Common alteration product of copper minerals, chalcopyrite, etc.

D. 332. M. & P. 289.

TERMINATED. An open crystal form, such as a prism, when closed by a pyramid or a base is said to be terminated by it.

TETRAGONAL. All crystal forms referable to 3 rectilinear directions (**axes**), **2 lateral of like** and **1 vertical of unlike** properties.

COMMON FORMS.

Base or Basal pinacoid, 2 faces of like properties, e.g., pearly, equal hardness, etc., parallel to the lateral axes: Apophyllite.

Prisms, 4 faces, etc., e.g., glassy, striated in same direction, etc., parallel to vertical axis: Apophyllite.

Pyramids, 8 faces, etc., cutting 1 or both lateral and the vertical axes: Zircon.

Sphenoid, 4 faces cutting 3 axes: Chalcopyrite.

TETRAHEDRITE. Copper sulfantimonate, $Cu_2Sb_2S_7$.

Massive, compact, granular, and tetrahedral crystals.

Metallic, brilliant to dull.

Dark lead- or steel-gray.

H. 3–4.5. Brittle. Arsenopyrite = 5.5–6; Magnetite = 5; Chalcopyrite = 3.5–4.

On charcoal = copper test.

Occ. Often in quartz with metallic sulfids and siderite.

D. 312. M. & P. 286.

TETRAHEDRON. See Isometric, Boracite, Tennantite, Tetrahedrite.

THOMSONITE. Hydrous sodium calcium aluminium silicate, $(Na_2Ca)Al_2(SiO_4)_2{+}2\frac{1}{2}H_2O$.

Radiated spherical concretions, columnar and compact.

Snow-white, reddish, green.

H. 5–5.5. Brittle.

Fuses with intumescence at 2 to white enamel.

Gelatinizes with HCl.

Occ. In cavities in amygdaloid with apophyllite, etc., sometimes with nephelite as alteration product.

D. 462. M. & P. 416.

THORITE. Thorium silicate, $ThSiO_4$.

Square prisms terminated with pyramid like zircon; also massive and compact.

Black, octahedron-like.

Bright orange-yellow, zircon-like.

H. 4.5–5.5. Zircon = 7.5–8.

Usually yields water in closed tube. Zircon does not.

Gelatinizes in HCl before, but not after, heating.

Occ. Very rare constituent of gneiss and granite, and with monazite sand.

D. 430. M. & P. 254.

THULITE. Rose-red Zoisite, q.v

TINCAL. See Borax.

TIN PYRITES. See Stannite.

TINSTONE. See Cassiterite.

TITANIC IRON ORE. See Ilmenite.

TITANITE. Calcium titanosilicate, $CaSiTiO_5$.

Massive, compact, rarely lamellar, and in monoclinic crystals.

Flat wedge-like crystals.

Resinous luster.

Dark brown to brownish yellow.

H. 5–5.5. Sphalerite and siderite = 3.5–4; Apatite = 5; Staurolite = 7–7.5.

Occasionally per., parting in 2 directions near amphibole Cv. in angle.

Fuses at 3 to colored glass.

Reacts for Ti.

Occ. Accessory rock constituent with pyroxene, amphibole, apatite, iron ores, etc.

D. 485. M. & P. 424.

TOPAZ. Aluminium fluosilicate, $(Al(F,OH))_2SiO_4$.

Colorless or yellow prisms variously modified. Massive, columnar, and granular.

Perfect basal cleavage.

H. 8. Quartz = 7 and lacks cleavage; Amblygonite = 6.

Reacts for fluorine.

Occ. In granite, gneiss, or volcanic rocks with apatite, fluorite, cassiterite, beryl, zircon, etc.

D. 431. M. & P. 403.

TOUCHSTONE. A velvet-black flint used for trying the streak of metals.

TOUGH. A mineral that is not easily broken and yields a rough fracture surface.

TOURMALINE. Complex boron-aluminium silicate, $R_9'Al_3(B.OH)_2Si_4O_{19}.R' = K$, Mn, Ca, Mg, Li, etc.

Striated prismatic hemimorphic crystals (often cross-fractured) with triangular cross-section. Massive, columnar, radiating, and compact.

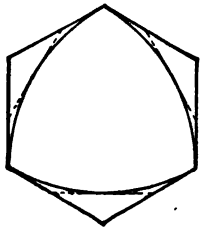

FIG. 17.—Composite diagram showing common cross-sections and derivation of triangular section.

H. 7–7.5. Hornblende = 5–6.

Lacks cleavage. Hornblende = prismatic perfect.

Fuses at 3.5 to globule or slag, or infusible, according to composition. Cassiterite infusible.

Occ. Especially in pegmatites with lepidolite, quartz, biotite, and feldspar; in calcite with tremolite at granite contacts; also in schist.

D. 447. M. & P. 409.

TRAPEZOHEDRON. See Isometric, Analcite, Garnet, Leucite.

TREMOLITE. Calcium magnesium silicate, $CaMg_3(SiO_3)_4$.

Massive radiated fibrous or light-colored monoclinic crystals with obtuse prism angle.

Sharp fibers with basal parting.

Perfect prismatic Cv. with 120° + angle. Pyroxene lacks per. Cv. or shows 90° angle.

Fuses at 4 with slight intumescence to a colorless or white glass.

H. 5–6. Sp.Gr.3.

Unattacked by HCl. Zeolites and wollastonite gelatinize.

Sometimes asbestiform (Asbestos).

Occ. Often in marble or calcite with brown tourmaline.

D. 400. M. & P. 390.

TRICLINIC. All crystal forms referable to **3 unlike inclined** directions **(axes).**

COMMON FORMS.

Pinacoids, 2 faces parallel to 2 axes. **Basal, Front, and Side:** Feldspars.

Hemi-prisms, 2 vertical faces: Axinite.

Hemi-domes, 2 lateral faces.

Quarter-pyramids, 2 faces.

TRIPHYLITE. Lithium iron fosfate, $LiFePO_4$, Mn iso.w. Fe.

Massive, cleavable to compact, rarely orthorhombic crystals.

Light blue, green, or gray.

H. 4.5–5. Spodumene and amblygonite = 6.

Basal perfect Cv., prismatic nearly perfect. Apatite lacks good Cv.

Cl.Tb. Turns dark and yields water.

Fuses 2.5 to magnetic globule. Spodumene = clear white non-magnetic glass; Amblygonite = opaque white non-magnetic enamel.

Occ. With spodumene, amblygonite, apatite, etc.

D. 496.

TROOSTITE. See Willemite.

TURKEY FAT ORE. See Smithsonite.

TURGITE. Ferric hydroxid, $Fe_4H_2O_7$.
Compact, fibrous divergent, botryoidal, stalactitic, earthy, and pseudomorphic.
H. 5–6.
Reddish black to dark red.
Streak red. Limonite = yellow.
In closed tube decrepitates strongly. Hematite and limonite do not.
See Hematite.
Occ. As alteration product of iron minerals, pyrite, etc.
D. 350. M. & P. 220.

TURQUOIS. Hydrous aluminium fosfate, $H(Al,2OH)_2PO_4$, iso.w. $H(Cu,OH)_2PO_4$.
Massive, reniform, stalactitic, and amorphous crusts.
Opaque, dull to waxy luster.
Blue to green.
H. 6. Chrysocolla = 3.
Reacts for P. Opal does not.
Infusible, turns brown and glassy.
Occ. In decomposed acid lavas in veins or patches.
D. 512. M. & P. 352.

TWIN CRYSTALS, Twins. A group of two or more crystals symmetrical to a common crystallographic plane. Such grouping often produces a pseudo-symmetry of a higher grade than that of the individual crystals. These crystals often show reentrant angles, and when the twinning is repeated (**polysynthetic**) fine parallel lines called **striations.**

ULEXITE. Hydrous sodium calcium borate, $NaCaB_5O_9 + 8H_2O$.
Cotton-boll-like masses of fibers easily crushed between the fingers.
H. 1. Silky feel.
Snow-white.
Yellow flame which becomes momentarily green on moistening with sulfuric acid.

Occ. In saline lake deposits with halite, glauberite, gypsum, etc.
D. 520. M. & P. 357.

URALITE. An amphibole pseudomorphic after pyroxene.

URANINITE. Chiefly lead uranyl uranate, may contain Ca, N, Th, Zr, Fe, Cu, Bi, Ce, Y, He(?), and radium.
Massive, botryoidal, granular, pitch-like, rarely small octahedrons.
Some shade of black, steel-gray, olive-green, dark brown.
H. 5.5. Brittle.
Infusible or 6.
Soluble in HNO_3 to yellow solution from which NH_4OH throws down a bright yellow precipitate.
Occ. In granitic rocks and in veins with metallic minerals.
D. 521. M. & P. 276.

UVAROVITE. Calcium chromium silicate, $Ca_3(Cr,Al)_2(SiO_4)_3$.
An **emerald-green** variety of Garnet, q.v. Small crystals or granular masses.
Occ. Sometimes as glassy crystals on chromite, and with calcite, diopside, and millerite.
D. 417. M. & P. 397.

VALENTINITE. Antimony trioxid, Sb_2O_3.
Prismatic orthorhombic crystals.
Cv. pinacoidal per. and prismatic.
H. 2.5–3.
Sp.Gr. 5.56
Fuses 1.5, dense white inodorous fumes.
Occ. With stibnite and antimony.
D. 330. M. & P. 275.

VANADINITE. Lead chlorvanadinate, $Pb_4(PbCl)(VO_4)_3$.
Small hexagonal prisms and earthy powder.
Bright orange and ruby-red.

H. 2.5–3. Pyromorphite and mimetite =3.5–4.

Fuses 1.5 to black mass yielding Pb in R.F. Pyromorphite =crystalline globule.

Occ. With wulfenite or galenite.

D. 500. M. & P. 264.

VESUVIANITE. Complex calcium aluminium silicate, $Ca_3(Al(OH, F)Al_2(SiO_4)_6)$, with Mn iso.w. Ca and Fe w. Al.

Massive, columnar, radiating, and granular. Tetragonal crystals.

Brown or green resinous.

Square prism striated vertically. Epidote =six-sided or lens-shaped prism; Tourmaline =three-sided prism; Pyroxene =square prism with inclined base.

Fuses at 3 with violent intumescence to a brown or green glass. Garnet = +3–7; Diopside =4 to a colorless or nearly colorless glass.

H. 6.5.

Occ. A contact product with calcite, garnet, and muscovite.

D. 427. M. & P. 401.

VIVIANITE. Ferrous fosfate, $Fe_3(PO_4)_2.8H_2O$.

Slender monoclinic striated prisms; acicular and earthy.

H. 1.5–2. Brittle.

Deep blue to indigo-blue.

Side pinacoidal Cv. per.

Occ. In crystals in pyrrhotite; as earthy masses in clay, fossils, etc.

D. 508. M. & P. 223.

WAVELLITE. Hydrous aluminium fosfate, $(Al,OH)_3(PO_4)_2.5H_2O$.

Massive, fibrous spheres, hemispheres, and radiating groups.

Green, white, manycolor.

Infusible, swells, colors flame green =P.

Soluble in HCl without gelatinization. Silicates gelatinize.

Occ. In veins and cavities in siliceous sediments, e.g., cherts.

D. 512. M. & P. 352.

WERNERITE. See Scapolite.

WHITE IRON PYRITES. See Marcasite.

WHITE LEAD ORE. See Cerussite.

WHITE MICA. See Muscovite.

WILLEMITE. Zinc silicate, Zn_2SiO_4, Mn iso.w. Zn.

Massive, granular, and rarely in prismatic hexagonal crystals.

Greasy luster, manycolor, prevailingly green.

Crystal terminations are rhombohedral. Apatite = pyramidal.

H. 5.5. Apatite = 5.

Sp.Gr. 3.9–4.2. Apatite = 3.2.

Infusible.

Occ. With franklinite and zincite in limestone.

D. 422. M. & P. 245.

WITHERITE. Barium carbonate, $BaCO_3$.

Heavy white or gray massive and pseudo-hexagonal twin pyramids.

Sp.Gr. 4.32. HEAVY. All other carbonates, except Cerussite = 6.48, and Smithsonite = 4.3–4.4, are lower.

H. 3.5.

Fuses at 2.5–3 to alkaline globule, colors flame yellow-green. Other carbonates are infusible, except Cerussite.

Effervesces in cold dilute HCl. Lacks rhombohedral Cv. of Calcite and radiating structure of Aragonite.

Occ. Vein filling with galenite.

D. 362. M. & P. 320.

WOLFRAMITE. Iron manganese tungstate, $(Fe,Mn)WO_4$.

Massive, bladed lamellar, columnar coarse divergent, granular, and in tabular to prismatic monoclinic crystals.

Dark gray to brownish black.
Submetallic luster.
Side pinacoidal Cv. per. Cassiterite has no Cv.
H. 5–5.5. Cassiterite=6–7.
Fuses 3–3.5 to magnetic crystalline globule.
Sp. Gr. 7.3.
Decomposes in HCl with separation of yellow powder (tungstic acid).
Occ. In tin-bearing veins with quartz, scheelite, pyrite, etc.
D. 539. M. & P. 225.

WOLLASTONITE. **Calcium silicate, $CaSiO_3$.**
Massive, fibrous, reticulated, and columnar. Monoclinic.
H. 4.5–5. Brittle.
Front and basal pinacoidal Cvs. per.
Sp.Gr. 2.8–2.9.
Gelatinizes in dilute HCl and reacts for Ca. Tremolite does not gelatinize and reacts for Mg in addition to Ca.
Fuses at 4 quietly to a white almost glassy globule.
Occ. With lime garnet, diopside, etc., as a contact product in granular limestone.
D. 394. M. & P. 387.

WULFENITE. **Lead molybdate, $PbMoO_4$.**
Thin tabular tetragonal crystals and massive granular.
Orange-red, wax-yellow, etc.
Resinous.
H. 3–5. Brittle.
Fuses 1.5–3. Reduces easily to metallic Pb.
Occ. With other lead minerals, vanadinite, pyromorphite, etc.
D. 541. M. & P. 265.

YELLOW COPPER ORE. See Chalcopyrite.

ZEOLITES. A group of secondary silicates found in seams and cavities of igneous rocks, formed chiefly by the alteration of the feldspars, nephelite and leucite. All contain water of crystallization. See Analcite, Chabazite, Gmelinite, Harmotome, Heulandite, Laumontite, Natrolite, Phillipsite, Scolecite, Stilbite, and Thomsonite.

ZINC BLENDE. See Sphalerite.

ZINCITE. Zinc oxid, ZnO with MnO.
Massive, granular, lamellar, very rarely in hexagonal crystals.
Ruby-red.
Stk. Orange-yellow.
Infusible. Realgar and cinnabar volatilize.
Occ. With franklinite and willemite.
D. 332. M. & P. 243.

ZIRCON. Zirconium silicate, $ZrSiO_4$.
Tetragonal prisms with steep and flat pyramids; lumps and grains.
Adamantine luster.
H. 7.5–8. Thorite = 4.5–5.
Sp.Gr. 4.7.
Infusible.
Occ. In black sand and as accessory mineral in granite, syenite, etc.
D. 429. M. & P. 402.

ZOISITE. Calcium aluminium silicate, united to Epidote by iso. replacement of Al by Fe. $Ca_2(Al,OH)Al_2(SiO_4)_3$.
Prismatic orthorhombic crystals, vertically striated, furrowed and cross-fractured, rarely terminated. Massive, columnar, fibrous, and compact.
Gray, white, green, brown.
Side pinacoidal Cv. per., pearly on face.
H. 6–6.5. Brittle.
Swells and fuses 3–3.5 to a white blebby mass. Hornblende = dark shiny globule.

Not soluble in HCl unless previously fused, when it gelatinizes.

Occ. In meta-igneous rocks rich in lime-plagioclase, actinolite, smaragdite, glaucophane, sometimes corundum, pyrrhotite, copper minerals, etc.

D. 437. M. & P. 406.

Richards, Ralph W
Synopsis of mineral characters.

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